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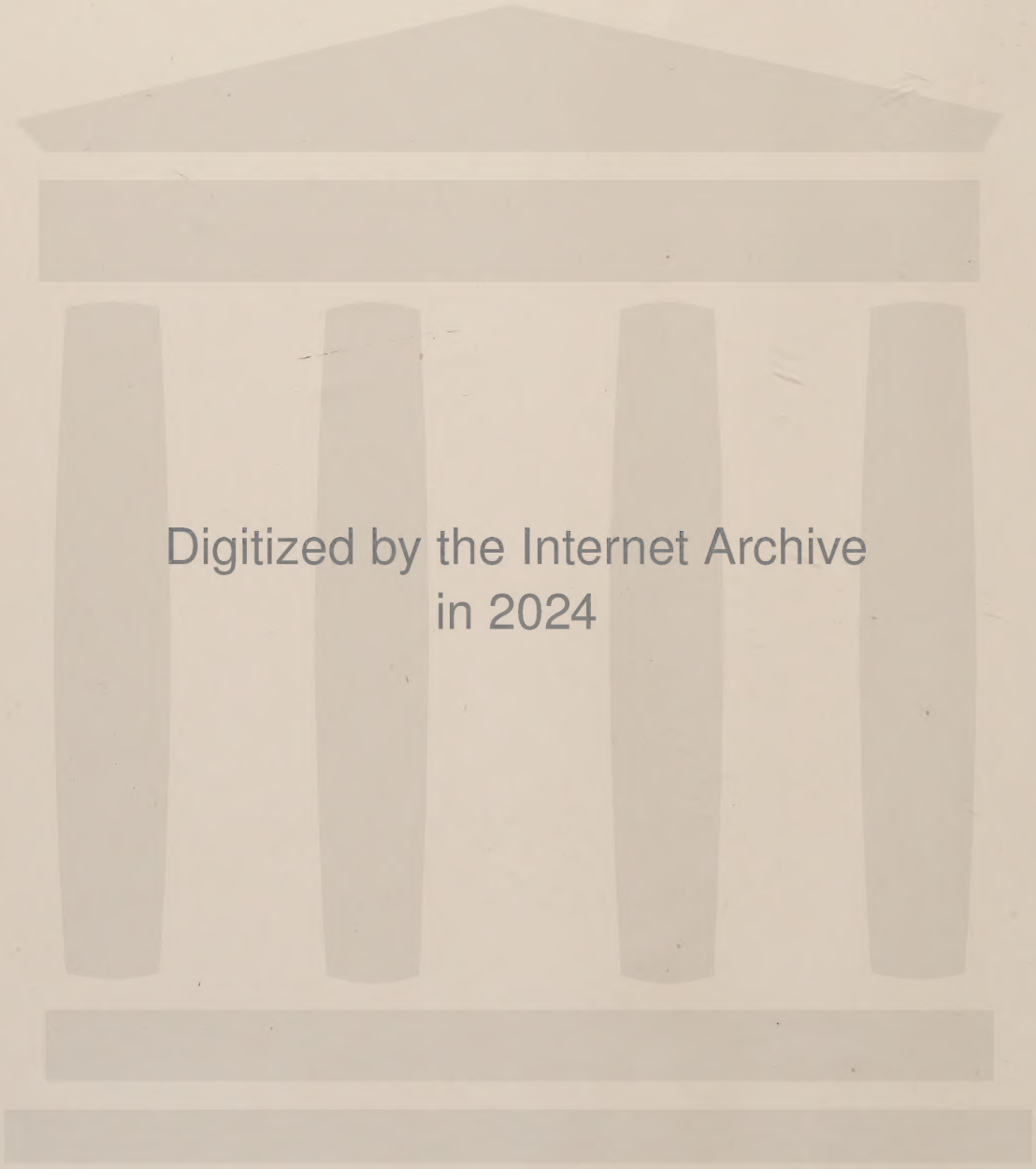

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Volume XII.

FIRST MEMOIR.

MONOGRAPH OF THE BOMBYCINE MOTHS OF NORTH AMERICA,

INCLUDING THEIR TRANSFORMATIONS AND ORIGIN OF THE LARVAL MARKINGS AND ARMATURE.

PART III.

FAMILIES CERATOCAMPIDÆ (EXCLUSIVE OF CERATOCAMPINÆ), SATURNIIDÆ, HEMILEUCIDÆ, AND BRAHMÆIDÆ.

BY

ALPHEUS SPRING PACKARD,

EDITED BY

THEODORE D. A. COCKERELL,

BEING A CONTINUATION OF PREVIOUS INVESTIGATIONS PUBLISHED AS VOLUME VII (FIRST MEMOIR) AND VOLUME IX (SECOND MEMOIR) OF THE MEMOIRS OF THE NATIONAL ACADEMY OF SCIENCES.

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PREFACE.

The manuscript and notes for this final volume of my husband's (Alpheus Spring Packard) Monograph of the Bombycine Moths are printed, with the exception of editorial additions, exactly as he left them at the time of his death on February 14, 1905. He had been working on them during the leisure intervals of college duties, and it was one of the last wishes he expressed that the National Academy of Sciences might consent to print the unfinished part, since they had already printed Parts I and II. My husband was fully aware of the incomplete condition of this later part, and had expected to spend much time in finishing it; he had also hoped to revisit the British Museum in order to work from the types in the collections there.

My husband's scientific friends who have been consulted in regard to printing have agreed that although these parts are incomplete, yet the valuable results of so many years of labor should be put into accessible and permanent form.

The accomplishment of this purpose is due above all to the labors of Prof. Theodore D. A. Cockerell, of the University of Colorado, who has most generously given his time to editing this volume. Without his kind and able assistance there would have been further delay of publication. I must leave to Prof. Cockerell all acknowledgments to those who have kindly helped him by supplying illustrations, etc. Our obligations are great to both Dr. Samuel Henshaw, of the Museum of Comparative Zoology, and to Miss Caroline G. Soule, of Brookline. We must ask my husband's many friends who furnished him so generously either with specimens or the results of their own observations to realize that through ignorance we can not make the proper acknowledgments, as he would have been careful to do.

ELIZABETH WALCOTT PACKARD.

ANDOVER, MASS., *July, 1912.*

INTRODUCTION.

The manuscripts left by Dr. Packard show that he contemplated what would have amounted to a monograph of the Saturnioid moths of the world. Beginning with the North American forms, he soon found it necessary to make comparisons with those of other regions, and during his last years was actively engaged in examining the many exotic genera. As all lepidopterists know, he was led to novel and interesting conclusions regarding the classification of these insects, parts of which were published in short papers before his death. It was in the monograph, however, that he hoped to fully expound and justify his opinions, while at the same time making known the life histories of the Saturnioids in a manner never before attempted. As will be seen from the following pages, great progress had been made, but very much remained to be done. The latest writings of Dr. Packard show that he was actively seeking new light and continually acquiring new information which led him to modify the details of his taxonomic scheme. It is impossible to say how much the work now presented would have been remodeled by him had he lived to this day, but it is at least certain that it would have undergone much modification and especially amplification. The editor has left the work exactly as it came from Dr. Packard's hands except in the following particulars:

(1) The arrangement is that of the editor, following, however, the order of genera preferred by Dr. Packard, so far as could be ascertained from a study of his writings.

(2) A few obvious slips of the pen have been corrected, and some very incomplete manuscripts have been omitted.

(3) Additions have been made, but in every case indicated by square brackets. Such additions are the work of the editor unless some other signature is appended.

It was evidently impossible to complete the work on the lines laid down by Dr. Packard, but it seemed practicable and desirable to bring the account of the North American species up to date. In the case of the exotic genera only enough has been added to bring out interesting points or give a general idea of the extent and distribution of the groups. A few genera have been entirely omitted, either because Dr. Packard made no reference to them or because they did not appear to belong to the families included in the work. It has often been necessary to add bibliographical references, and when these could not be verified from the original works Kirby's Catalogue was the source of information.

The editor is greatly indebted to many kind friends and correspondents who did everything in their power to aid in the work. Dr. H. G. Dyar supplied much valuable material and answered many questions, and also selected from the collection in the United States National Museum a splendid series of moths to be photographed, enabling us to illustrate for the first time and from the original types many American species. Mr. J. H. Watson, of Manchester, England, aided by the loan of literature, by answering questions, and especially by supplying a very fine series of photographs representing numerous genera discussed by Dr. Packard, but represented only by drawings of venation, or not at all, among the illustrations left by him. Dr. J. McDunnough, of Decatur, Ill., has kindly prepared descriptions of several North American species and has sent photographs of rare forms in the Barnes collection. Dr. L. O. Howard and his associates in the Bureau of Entomology, United States Department of Agriculture, have placed at my disposal the numerous manuscript records of the bureau. Mr. Jacob Doll, of the Brooklyn Museum, very kindly sent photographs of the North American species in his charge not otherwise represented on our plates. Dr. Glover M. Allen copied several descriptions inaccessible to me and looked up a number of doubtful references. Other assistance is mentioned at various places in the text, but it has been impossible to acknowledge in any sufficient way the results of Mrs. Packard's always active interest and cooperation.

On the financial side we are greatly indebted to the trustees of the Bache fund for a grant of $200 toward the cost of the preparation of the plates.

T. D. A. Cockerell.

University of Colorado, Boulder, Colo., *August, 1912.*

THE BOMBYCINE MOTHS OF NORTH AMERICA, PART III.

By Alpheus Spring Packard.

Superfamily SYSSPHINGINA Packard.

Family CERATOCAMPIDÆ (Harris) Packard.[1]

Subfamily 1. Ceratocampinæ Grote.

(See Part II, Memoirs of the National Academy of Sciences, vol. 9.)

Subfamily 2. Agliinæ Packard.

Agliinæ Packard, Proc. Amer. Phil. Soc. [XXI (1893), p. 139].
Agliinæ Packard, Ann. and Mag. Nat. Hist. [(6), XI (1893), pp. 172–175].

Head rather large, unusually narrow between the eyes; the vestiture rather long, but not shaggy or radiating.

Antennæ of ♂ varying greatly, either bipectinated, with short very densely ciliated branches (*Arsenura*), or the branches still shorter, forming almost simple teeth, much ciliated (*Dysdæmonia*), or very widely pectinated to the tip (*Aglia* and *Polythysana*), or moderately bipectinated nearly to the tip (*Bathyphlebia*). In ♀ either with very short pectination (*Aglia, Polythysana*), or entirely simple (*Arsenura* and *Dysdæmonia*). Palpi very constant in form, being unusually well developed, large, compressed, ascending, passing beyond the front, distinctly 3-jointed, reminding one often of the Sphingidæ. Maxillæ unusually well developed, though slender and short; in *Dysdæmonia* the two appendages are united for about half their length, and they are as long as the head is broad, or about one-third as long as the ♂ antennæ. Thorax rather stout, abdomen conical. Wings often large; fore wings with the costa much curved on the outer half; the apex either somewhat produced and rounded, or broad and square (*Dysdæmonia*); outer edge normal, moderately full (*Aglia*) or slightly falcate (*Polythysana* and *Arsenura*), or much so, and the outer edge deeply excavated and scalloped in *Dysdæmonia*.

Hind wings either normal, with the outer edge either full and rounded (*Aglia, Polythysana*); or with a long angular projection at the end of veins III_2 and III_3 (*Arsenura*), or in *Dysdæmonia*, with a rather long tail widening at the square, flaring end, supported by veins III_2 and III_3.

Venation: Fore wings, with 11 veins; vein III_2 independent, entirely detached from its original vein or stalk (*Arsenura* and *Dysdæmonia*); in *Aglia* and *Polythysana* the vein is less detached. In all the genera examined the vein II_1 arises within the origin of the anterior discal vein, while the origin of this vein, in *Aglia*, is situated nearer to the discal vein than in any other genus of the group. Another almost diagnostic character of the subfamily is the small size of the discal cell; in all the genera the outer end or side is situated well inside of the middle of the wing; it is widest in *Dysdæmonia*, narrowest in *Arsenura*.

Hind wings with eight veins; the discal cell is small and short, except in *Polythysana*, where it is two-thirds as long as the entire wing along the median vein (IV), the genus being very aberrant in this respect.

The common line formed by the two discal veins taken together is very oblique (*Arsenura*); in *Aglia* much less so. In the venation of the hind wings *Aglia* is in all important respects much like *Arsenura* and *Dysdæmonia*.

Legs rather large, long, and slender.

[1] [According to Art. 5 of the International Rules of Zoological Nomenclature, this family must be called Citheroniidæ Dyar, 1894, and the subfamily must be Citheroniinæ.]

Larva in its last stage spineless, smooth; in the early stages with 2 to 6 thoracic spines, and a median double spine on eighth abdominal segment. *Pupa* like that of *Eacles* [Packard, Psyche, Feb. 1902, p. 305].

Judging by the adult characters the *Agliinæ* may be divided into three groups, the first being represented by *Arsenura*, which appears to be the most generalized form, its ally, *Dysdæmonia*, being more specialized, having undergone reduction in its maxillæ, but a higher degree of specialization as seen in its tailed hind wings, and the diaphanous discal and secondary spots, as also the highly modified, almost simple, but densely ciliated antennæ. The second group is represented by *Aglia*, and apparently *Bathyphlebia*.

The third by *Polythysana*.

It is quite apparent that *Aglia* is an offshoot of the *Arsenura* phylum. As to the origin of *Polythysana*, that remains to be settled after we have a knowledge of the larva and all its stages. Until its transformations became known and comparisons made with those of Sphingidæ and Ceratocampidæ, the European *Aglia tau* was allowed to remain in the family Saturniidæ, as formerly understood.

ARSENURA Duncan.

Phalæna-Attacus CRAMER, Papillons Exotiques, III, t. 197A, 1782.
Arsenura DUNCAN, Naturalists Library, p. 125 (no description), "1837."
Rhescyntis group 2, WALKER, Cat. Lep. Het. Br. Mus., VI, p. 1323, 1855.
Arsenura DRUCE, Biologia Centrali-amer., Lep. Het., I, 1886.
Arsenura KIRBY, Syn. Cat. Lep. Het., 1, p. 769, 1892.

Imago.— ♂ and ♀. Head of moderate size; in front between the eyes unusually narrow, the sides nearly parallel; when denuded, the front is unusually narrow, flat, not much narrower at the front edge than at the vertex, even a little narrower than the width of one eye; eyes rather large, round.

Female antennæ well pectinated to near the tip, the joints long, each one with two pairs of densely ciliated pectinations; each pair of branches situated close together and of nearly equal size and length, but diverging at their tips. Palpi porrect, very large, thick, longer than usual, extending well beyond the front; third joint short and small, not very distinct from the end of the second; when denuded the second joint is seen to be very long, about four times as long as the basal one, the third joint being very small, almost minute. Maxillæ vestigial, either microscopic in size, forming two separate processes, one on each side of the mouth and turned upward, or in *A. xanthopus* united, well developed, forming two coils.

Fore wings of ♂ moderately wide, costa well curved toward the apex, which is rather blunt, falcate, outer edge a little hollowed out; outer edge longer than the inner; wings of ♀ wider, less arched on the costa and less falcate. Hind wings with no costal enlargement as in Citheroniinæ; the apex well rounded; outer edge with a well marked angle, almost suggesting a tail, in ♀ rounded; above the angle the wing is somewhat excavated, less so in ♀ than in ♂.

Venation nearly as in *Citheronia;* vein II_2 being present, but differs in vein III_1 arising at the same point as the anterior discal vein; vein III_2 arises nearly as far from vein IV_1 as from III_1; vein II_1 arises far within the discal veins, toward the base of the wing. Discal cell small, but larger than in *Citheronia*.

In the hind wings vein II arises very near the discal vein and origin of III_1; the origin of III_2 is nearly midway between that of III_1 and III_3; the two discal veins taken together form a very oblique line.

Legs rather long; odoriferous sack in fore tibia unusually narrow, pointed, slightly over one-half as long as the tibia, acute at tip, lying at the bottom of a depression, and at the base partly concealed by hairs. Abdomen rather slender and reaching nearly to the end of the hind wings. Markings: Ground color fawn-brown, with only a slight indistinct line in place of a discal spot; extradiscal line on each wing composed of a few large uneven scallops.

Genitalia.—Suranal plate large, about twice as long as broad, the end curved in, extending out as far as the upper clasper; the latter rather large, broad, the end a single acute incurved point, hook-like and roughened; seen from directly above or beneath they are narrow; the

claspers of the lower pair at base not differentiated from the upper claspers, incurved, blunt at the end, which does not extend beyond the outer fourth of the length of the upper claspers.

Geographical distribution.—The species range from Mexico to Brazil, being characteristic neogæic forms.

Larva.—The full-fed larvæ of this genus, as in *Aglia tau* and *Cercophana*, are unarmed, without any characteristic humps or spines, while the freshly hatched larvæ entirely differ in bristling with forked spines or flexible horns, these characters not being thrown off until the last ecdysis.

Stage I.—Two large 5-headed prothoracic dorsal setiferous spines; mesothoracic dorsal spines reduced, minute, while those of the third thoracic segment are enormous, about half as long as the body, flexible, forked at the end; caudal horn in shape like the metathoracic ones, but about one-third as long. The long setæ arising from all the tubercles are black and spinulose.

Later stage to the last molt. The partly grown larva, when about one-half grown, is drawn as having a pair of high horns on the prothoracic and a longer pair on the third thoracic segment, and a caudal horn on the eighth segment, also a shorter median horn on the ninth abdominal segment. Peters [1] states that this armature is retained until the last molt. Heretofore we have only had the figures of the mature larva of three species of this genus, and four sketches of the caterpillar of *A. armida*, the better known species of this interesting genus, which ranges from Mexico to Brazil. The larva figured by Madam Merian, Stoll, Burmeister, and by Peters, is represented as being smooth, without any tubercles, horns, or hairs.

Fully fed larva.—Either without any spines or tubercles, the body being smooth, unarmed, and of a generalized form (*A. armida*), or apparently the four thoracic and the caudal horn of the earlier stages are retained after the last molt (*A. aspasia* and *A. xanthopus*). This remains to be verified.

We had from a study of this genus (also of *Rhescyntis* and *Dysdaemonia*) referred these moths to the subfamily Agliinæ, the venation being similar to that of *Aglia tau*. And it is a matter of no little interest to find that the young freshly hatched larva is somewhat similar in armature to that European genus, whose nearest allies belong to the South American fauna, and also to *Cercophana*.

ARSENURA XANTHOPUS (Walker).

Rhescyntis xanthopus Walker, Cat. Lep. Het. Br. Mus., VI, p. 1327, 1855.
Rhescyntis xanthopus Kirby, Syn. Cat. Lep. Het., I, p. 769, 1892.

LARVA.

Peters, Het.-Raupen, Taf. II, figs. 2, 2a, p. 9, 1898–1901. Pupa also figured.

Imago.—2 ♂. Antennæ more completely bipectinated, and the pectinations much longer than in the other species examined by me; those of the distal pairs but little shorter and smaller than those of the basal pair; the joints slender and pectinated to the tip of the antenna. Palpi stout as usual. Head dark vandyke brown, with no pale band between and pale tufts at the base of each antenna as occurs in *A. armida*. Maxillæ unusually well developed, very slender, united, and making about two coils. Body stouter than in *A. armida*.

Fore wings a little more rounded at the apex and less subfalcate than in *A. armida;* hind wings not excavated behind the apex, as they are in *A. armida*. Markings quite different from those of *A. armida* and *pandora*, though the ground color is the same fawn color with vandyke brown shades and lines. Basal line bent rectangularly and sending a point toward the hinder end of the discal spot, and inclosing an oblong ash-fawn area, which also extends beyond the basal line along the costa to the outer third of the costa, and incloses the large distinct lunate discal spot, which is more distinct than in the other species examined by me. Extradiscal line pale cream white, very deeply sinuous, the middle loop not divided into two scallops in the middle of the wing as in *A. armida* and *pandora;* beyond are two series of fawn-colored lunules with two linear whitish lines, and a submarginal row of vandyke brown lunules

[1] Die Heteroceren-Raupen (und Puppen) des H. T. Petersschen manuskriptwerkes; Biologische Beiträge zur Brasilianischen Schmetterlingsfauna, Neudamm (1898)–1901.

on both wings. The brown lunules toward the apex and the costo-apical black spot edged with blue scales are much as in *A. pandora*, but there is no distinct red patch beyond; it is only faintly indicated. The angle or loop made just behind the subcostal ocellus is angular, and more as in *A. armida* than in *pandora*.

Hind wings with a narrow lunate discal spot, more distinct than in *A. armida* or *pandora*.

Under side of the wings with the lines, discal spot and costo-apical ocellus and lines much as above, though the ground color is paler. The submarginal line of lunules is obsolete behind the red and brown marks of the apical region, and on the hind wings the submarginal pale lilac line and the brown lunules beyond are distinct, and not present in *A. armida*. On each side of the abdomen are short six luteous or pale yellowish-brown spots. The specific name applies with less force to this than the other species, the tarsi being scarcely paler than the base of the legs.

Expanse of fore wings, ♂ 114 mm.
Length of a fore wing, ♂ 60 mm.
Breadth of a fore wing, ♂ 32 mm.
Length of a hind wing, ♂ 45 mm.
Breadth of a hind wing, ♂ 34 mm.

This species, with its well pectinated ♂ antennæ, well-developed tongue, discal spot, entire nonfalcate fore wings, and rounded hind wings, appears to be the most primitive or generalized species of the genus, and *A. richardsoni* the most specialized and recently evolved form. The fact that the mature larva retains two long thoracic filamental appendages is a further proof of the primitive nature of this species.

Larva.—Stage III. The small young (in stage III?) has a pair of long, slender filamental metathoracic horns about half as long as the body, and a caudal filamental horn of nearly the same length.

Full-fed larva.—The older larva has no caudal horn, but retains the two thoracic appendages, which are about a quarter as long as the body. The methathoracic segment is much swollen, while the dorsal surface of the eighth abdominal segment presents a broad, slightly concave smooth surface. Peters does not positively say whether this is the full-fed larva or not, but the pupa (subterranean) is figured.

Peters describes the larva as dark gray, sprinkled with brown; with a yellow lateral line and yellow with black markings on the head and tail end. Pupa of the same general appearance as that of *A. armida*.

Food plant.—It lives exclusively on a shrub with a bur-like fruit, called locally "carapicho" (*Urena sinuata*).

Geographical distribution.—Petropolis, Brazil (J. G. Fetterle), Brazil (J. Doll). Only in the mountainous country near Rio (Peters).

ARSENURA PANDORA (Klug).

Saturnia pandora Klug, Neue Schmett., I, p. 6, Taf. 5, fig. 2, 1836.
Rhescyntis pandora Maassen and Weymer, Beitrage z. Schmett., I, fig. 3, 1869.
Arsenura pandora Kirby, Syn. Cat. Lep. Het., I, p. 769, 1892.
Arsenura xanthopus Peters, Het.-Raupen., p. 9, 1898–1901.

Imago.—1 ♂, 1 ♀. Though a much larger species, allied to *A. armida* in the shape of the wings and the markings, though the hind wings of ♂ are not angulated. Antennæ of ♂ with a little longer cilia, ♀ antennæ simple, one-half as wide as in ♂, with fine cilia. Palpi the same as in *A. armida*.

Fore wings, apex much rounder, not falcate, scarcely subfalcate, outer edge slightly excavated. Hind wings of ♂ not angulated, outer edge full, rounded, the same in both sexes, and the markings the same. Ground color dark fawn and vandyke brown. Fore wings with the basal line distinct, dark, sending a point out along the median vein; within this line the wing is ashen fawn (♂) or dark fawn (♀). Extradiscal faint, dark, somewhat sinuous; the submarginal line very distinct, whitish, within vandyke brown, very sinuous, two deep sinuses, one bent in toward the discal spot, the other on the inner edge of the wing; each sinus divided

into two scallops, the line ending at the costa just inside of the costo-apical spot. The line is bordered externally with two lilac and a white and broad reddish vandyke brown line; this shade widens in the sinus; the apex is pale reddish; the edge of the wing fawn color. Costo-apical spot black, irregularly oval, edged within with a blue semicircle and a few blue scales on the costal side; the narrow blue-white submarginal line ending on the outer edge of the spot, and besides two parallel blue-white streaks pass toward the apex. (This spot is larger, much more perfect and specialized than in *A. armida;* the same in ♀.) Discal spot ovo-lunate, dark vandyke brown, paler within and with a clear central line or fissue; or the entire spot is dark, opake.

Hind wings vandyke brown, paler toward the base, no basal lines, a very faint discoloration; outer line much as in the fore wings, curved outwards on the second median; a submarginal series of seven larger unequal round nearly separate scallops, umber or pale vandyke brown in color. Under side of wings of a uniform ash yellowish brown; all four discal spots present and quite distinct; the submarginal line yellowish brown, but otherwise as above, as are the costo-apical black ocellus, and the white and broad madder-red curved streak; hind wings with the lines much as above. Legs brown, but all the tarsi yellowish brown.

Expanse of the fore wings, ♂ 103 mm.; ♀ 160 mm.
Length of a fore wing, ♂ 53 mm.; ♀ 88 mm.
Breadth of a fore wing, ♂ 29 mm.; ♀ 48 mm.
Length of hind wing, ♂ 39 mm.; ♀ 64 mm.
Breadth of hind wing, ♂ 35 mm.; ♀ 50 mm.

Bonninghausen in Peters' Heteroceren-Raupen, etc., page 9, gives *A. xanthopus* as a synonym of *A. pandora,* but until I have been able to make further examination and comparison I should prefer to keep them distinct.

Geographical distribution.—Santa Catarina, Brazil (American Museum of Natural History, New York); Brazil (Doll).

ARSENURA ARMIDA (Cramer).

Phalaena-Attacus armida Cramer, Papillons Exotiques, III, p. 6, Tab. 197A, 1782.
Phalaena-Attacus cassandra Cramer, Papillons Exotiques, III, p. 7, Tab. 197B, 1782.
Bombyx erythrinæ, Fabricius, Species Ind., II, p. 169, No. 9, 1781; Mantissa Ins., II, 108, 10; Ent. Syst., III, p. 411, No. 13.
Rhescyntis erythrinæ Hübner, Verz., p. 156, 1822?
Rhescyntis cassandra Hübner, Verz., p. 156, 1822?
Arsenura armida Duncan, Naturalists' Library, p. 125 [1837].
Rhescyntis erythrinæ Walker, Cat. Lep.-Het. Br. Mus., VI, p. 1324, 1855.
Arsenura armida Druce, Biologia Centrali-amer., Lep.-Het., I, 1886.
Rhescyntis erythrinæ Preuss, Abbild. Nachtschmett., p. 9, Tab. 12, fig. 1, 1888.
Arsenura armida Kirby, Syn. Cat. Lep.-Het., I, p. 770, 1892.

LARVA.

Merian, M. S., Metamorphosis Insectorum Surinamensium, Pl. XI, p. 11, 1705.
Stoll, C. Supple. Cramer's Pap. Exot., Pl. XIX, 1787–91, figs. 1 and 2.
(Larva, final and an earlier half grown stage; pupa, ♂ and ♀; young and full-fed larva.)
Burmeister, H., Description phys. Rep. Argentine, Lep., Atlas, Liv. 1 and 2, p. 47, Pl. XXI, figs. 1, 1A, 1879–80.
Peters, H. T., Die Heteroceren-Raupen, p. 9, Taf. VI, fig. 9, 1898–1901.
(Young, half grown, and full fed or last stage.)

Imago.—1 ♂ 1 ♀. Body and wings uniformly fawn brown, the ♂ a little darker than ♀. Head and palpi much darker than the rest of the body. Fore and hind wings not scalloped on the edges. Fore wings with a broad diffuse basal line situated much nearer the discal streak than the base of the wing; on the outer or hinder half of the wing it is curved outward. Discal spot an indistinct broad line alike on both wings. Extradiscal line dark fawn, oblique, not waved or scalloped, slightly excurved on inner edge of wing, ending on the costa on the outer third of the wing. Halfway between the end of this line and the apex of the wing is a double dark-brown irregular costal streak, from which passes a white line to the apex. A sinuous white line edged more or less distinctly on each side curving outward in a large scallop toward the apex and behind the double blackish spot; it makes two similar scallops in the middle of

the wing. In the apical region are two linear white scallops, the hinder one bordered with an oblique chestnut-brown streak reaching the extradiscal line. Beyond the extradiscal line the wing is clear fawn brown, while within the extradiscal line the wing (except on the inner edge) in hoary or gray, much less so in ♂ than in ♀, with the angle in male well marked. Hind wings colored and marked like the fore wings; no basal line. The extradiscal line broad, straight, dark, and touching the submarginal scalloped line on the inner edge of the wing. This line is made up of six scallops, with dark points between them, the first, fourth, and fifth points three times larger than the second and third; in the ♂ the points are more nearly equal in size and form a more continuous blackish line, with scattered white scales.

Beneath slightly paler, but the lines and other markings are as on the upper side though less distinct, and the dark submarginal line is nearly effaced in the middle of the wing away from the costal and inner edge of the wing. Legs: The femora and tibiæ dark, like the palpi, but the tarsi are much paler. Abdomen with a row of six lighter oval triangular spots encircled with dark on each side.

Expanse of fore wings, ♂ 120 mm.; ♀ 142 mm.
Length of fore wings, ♂ 62 mm.; ♀ 70 mm.
Breadth of fore wings, ♂ 30 mm.; ♀ 36 mm.
Length of hind wings, ♂ 46 mm.; ♀ 47 mm.
Breadth of hind wings, ♂ 30 mm.; ♀ 38 mm.

One ♂ from Mexico is most probably this; it only differs in being darker, with all the lines and spots more distinct; it differs chiefly in the extradiscal line in both wings being somewhat sinuous. Length of fore wings 60 mm., breadth 33 mm.

Geographical distribution.—Vera Cruz, Mexico (G. Franck); Jalapa, Mexico; Surinam (very common, Cramer); Venezuela and Brazil (British Mus.). My Mexican one is like Cramer's figure of *A. cassandra*, the extradiscal line being more wavy, especially that on hind wings.

Fully fed larva.—The body is entirely unarmed, with no apparent vestiges (in the figure) of the armature of the earlier stages. The body differs from that of *Aglia* and *Cercophana* in being elongated, while the outline is that of a generalized or noctuiform larva, the thoracic segments being of normal size, and the larva apparently does not strike the singular attitude of those of *Aglia* and *Cercophana;* in fact the larva looks like that of a *Cossus*.

The body is dark brown, contrasting with the orange red of the head, prothoracic shield, suranal plate and anal legs, as well as the four pairs of midabdominal legs. Peters describes and figures the fully fed larva as dark gray ringed with black.

Pupa.—(Sent me as such by Mr. O. Barrett and identified by E. A. Smyth.)

Stoll figures the adult larva and that of an earlier stage of his *A. cassandra*, now regarded as a synonym of *A. armida*. In both stages the body is yellow, with irregular dark markings, but otherwise it is as in his figure of the larva of *A. armida*. The young larva is armed as in the normal young of *A. armida*, figured on the same plate.

The larva spins no cocoon, but pupates 6 inches below the surface of the soil.

Food plant.—In Nova Friburgo, Brazil, the larva occurs in great numbers on an *Anona*, the genus to which the custard apple belongs; at Petropolis, Peters often found it "in enormous numbers" on the Paineira, *Bombax ceiba* L. In Surinam it lives on the "Palisade tree" (Merian).

ARSENURA ASPASIA (Herrich-Schaeffer).

Arsenura (Rhescyntis) aspasia. Herrich-Schaeffer, Samml ausser-eur. Schmett., p. 60, fig. 51, 1854.
Rhescyntis aspasia Walker, Cat. Lep. Het. Br. Mus., VI, p. 1326, 1855.
Arsenura aspasia Peters, Die Heteroceren-Raupen, p. 9, Larva, Taf. IV, fig. 7; Pupa, 7a, 1898–1901.

LARVA.

Peters, Die Heteroceren-Raupen, Taf. IV, fig. 7.

Judging from Herrich-Schaeffer's figure, this is a larger species than *A. armida* (expanding 170 mm.), but with wings of similar shape; the markings are closely similar; the costo-apical oval mark is larger, but the extradiscal line is nearly the same, though the scallops differ in slight details. It may be found to intergrade with *A. armida*.

Larva.—Peters figures the caterpillar of this species, which has four short thoracic and a conical caudal horn; one would infer from his brief account that this larva was fully fed, since he figures the pupa, but it may be found to belong to the penultimate stage. He states that it is gray, marked with brown. It was found only once by Peters on a large forest tree with leaves like the hazel. It became well known to him in Petropolis, where it lives on a high stemmed Melastomaceous tree.

Pupa.—As figured by Peters the body is rather thick, with a cremaster of moderate size, and not differing in general appearance from that of *A. armida.*

Geographical distribution.—Brazil (Herrich-Schaeffer, Walker). Peters states that it is very rare and only found in the high mountain region.

ARSENURA SYLLA (Cramer).

Phalæna-Attacus sylla Cramer, Papillons Exotiques, III, p. 79, Pl. CCXLA.
Rhescyntis sylla Hübner, Verzeichniss bek. Schmett., p. 156, 1818, 1779 (?).
Rhescyntis sylla Walker, Cat. Lep. Het. Br. Mus., VI, p. 1325, 1855.
Arsenura sylla Kirby, Syn. Cat. Lep. Het., I, p. 769, 1892.

This species is larger, but approaches *A. armida* in the shape and markings of the wings, though sufficiently distinct. The extradiscal lines on both wings are in general similar, but flesh-colored, and accompanied by a grayish scalloped shade on both wings. A more decided oval discal spot; no basal line present. The apical marks on the fore wings somewhat as in *A. armida.*

Geographical distribution.—Surinam (Cramer); Para (British Museum). [Jordan, Nov. Zool., 1911, describes *A. sylla pelias,* placing it in *Rhescyntis.*]

ARSENURA BATESII Felder.

Arsenura batesii Felder, Reise der Novara, Pl. XCI, fig. 2, 1874.
Rhescyntis batesii Preuss, Abbild, Nachtschmett., p. 7, Tab. 12, fig. 3, 1888.
Arsenura batesii Kirby, Syn. Cat. Lep. Het., I, p. 769, 1892.

Imago.—This is a larger species than *A. armida,* with rather deeply scalloped wings, especially the hinder pair, but the markings are of the same type, though the discal spot on the fore wings is connected with the basal line, making a large oblong inclosure, and the discal spot on the hind wing incloses a small oval space. The extradiscal line is more scalloped than in my Mexican example of *A. armida.*

Geographical distribution.—Brazil.

ARSENURA PONDEROSA Rothschild.

Arsenura ponderosa Rothschild, Nov. Zool., II, p. 48, 1895.

Imago.—"This curious species is quite unlike any other of the genus.

"Fore wings, ground color clay yellow washed with yellowish buff. Wings crossed obliquely from the apex to near the base of the inner margin by a broad blackish brown line, which is wavy and less conspicuous in the apical half. This line runs parallel with the costa, and not at an angle with it, as usual; within the cell is a half-moon-shaped broad but indistinct line, and a narrower but more irregular one at the apex of cell. The outer half of both wings is crossed by two transverse and parallel broad lines. The outer one bears on the fore wings four buff patches, of which the anterior one in front of the upper median nervule is much the largest and almost square. The space between these two lines is narrower than between the outer one and the margin, and is decidedly yellower.

"Hind wings similar to fore wings, but the outer line is double, gradually merging into one toward the anal angle, when it exhibits a yellow patch.

"Head and collar brown, with a white mark between the antennæ.

"Thorax and abdomen pale buff.

"Underside pale buff, the oblique band on fore wings wanting, and the two transverse bands much less distinct, the outer one nearer margin, and dissolved into blackish and ruddy

spots at the nervules. On the hind wings at the apex of cell is a small brown ring with a central spot.

"Expanse, 8.5 inches = 215 mm.

"Hab. Chuchuras, East Peru. (In coll. Staudinger.)"

ARSENURA RICHARDSONI Druce.

Arsenura richardsoni Druce, Biologia Centrali-amer., Lep. Het., III, plate 83, fig. 1; Ann. Mag. Nat. Hist., (6) V, p. 215, 1890.

Arsenura richardsoni Kirby, Syn. Cat. Lep. Het., I, p. 770, 1892.

Imago.—1 ♂. Fore wings more falcate, with the apex more produced, and hind wings much more angulated (almost tailed) than in ♂ *A. armida.* Antennæ of ♂ as in ♂ *A. armida,* the pectinations being short, vestigial, and much ciliated. Head in front a little narrower than in *A. armida,* and the palpi larger and longer, more prominent. Body of the same size as in *A. armida.*

Fore wings more falcate, being decidedly so, than in *A. armida, arcaei, pandora,* and *xanthopus,* but not so much so as in *A. championi.* Costa a little more arched; apex more produced and outer edge more deeply excavated than any species except *A. championi.*

Hind wings with the apex rounded, the middle of the outer edge produced into a decided angle or point on the independent vein.

The ground color darker vandyke or deep chestnut brown than in *A. armida* and *pandora.* The markings are much less distinct than in the other species. The fore wings with an obscure basal dark line or shade. Discal spot distinct, roundish lunate, in the middle paler, forming a linear pale streak, sending a short streak along the base of the independent vein. Halfway between the discal spot and submarginal line is a broad dusky extradiscal shade; between it and the submarginal 6-scalloped line the wing is dark chestnut brown. Outer edge of the wing beyond the line is darker than in the other species named. A large suboval black costo-apical spot slightly edged with pale blue scales; this spot is much larger than in *A. armida;* no pale red patch beyond the costo-apical spot, but behind it three or four deep madder-red slashes. Hind wings marked like the fore wings, but no trace of a discal spot. Three dark excurved parallel shades; the outer margin as on the fore wings, with two madder-red spots, one at the base of the tail.

Underside of the wings uniformly dark fawn brown, with scattered darker spots; no discal spots. Two broad very diffuse dark brown shades, while the outer third of the wings of both pairs is hoary, though the outer edge is free from the whitish scales.

Expanse of the fore wings, ♂ 125 mm.
Length of a fore wing, ♂ 68 mm.
Breadth of a fore wing, ♂ 37 mm.
Length of a hind wing, ♂ 57 mm.
Breadth of a hind wing, ♂ 40 mm.

Geographical distribution.—Eastern Mexico (Doll) (Druce).

The eggs of this rare species were kindly sent me from Tacubaja, Mexico, by Mr. O. W. Barrett. The food-plant of the caterpillar was unknown to him.

Stage I.—Length, 4 mm. Head large and round, wider than the body, and shaped as in *Adelocephala.* The body is rather thick, and tapers somewhat to the end. The first thoracic segment is rather wide, but not so wide as the head; the front edge is somewhat raised, i. e., flares up, and bears a remarkably complex armature. The two dorsal tubercles are broad, thin (in a fore-and-aft sense), and divided into seven heads or subtubercles, one or two of which are smaller and shorter than the others, each digitiform tuberculet bearing a long spinulate black seta; the setæ are of nearly equal length, and nearly as long as the entire main or master tubercle. As compared with those of *Eacles imperialis,* stage I, these tubercles are much thinner, and are 7-headed instead of being 2-headed, i. e., simply forked.

Below on the front edge of each side is a smaller tubercle of the subdorsal series about one-third as long and large as those of the dorsal pair, ending in three subtubercles, each of which

bears a black spinulated seta. Just below the spiracle is a small, simple, infraspiracular tubercle, and below this a low minute 3-headed one. Behind this series of four tubercles (on each side) is a dusky, narrow, chitinous band or rudimentary prothoracic plate or shield, which passes down each side of the segment, not quite reaching a point opposite the spiracle, i. e., not as far down as the spiracle.

On the second thoracic segment are two dorsal tubercles (*i*), which are small, digitiform, 2-headed, the heads diverging. These are smaller than the corresponding pair on the first abdominal segment, but larger than those of the hinder pair (*ii*) on the same abdominal segment.

On the third thoracic segment is a pair of enormous horns, which are slightly more than half as long as the body. They are not stiff, and easily bend over, but with a thin integument, the surface of which is crowded with short, erect spinules, some of which are conical, others blunt. These two appendages are nearly as thick as the segment is long, their greatest diameter being a little above the base; they are forked at the end, each fork being about twice as long as thick, and much rounded at the end, and giving rise to a stout spinulated seta, which is of moderate length, i. e., about twice as long as the greatest diameter of the horn itself. The horns of this pair are much larger than those of *Aglia tau* of the same stage, and differ in the trunk, and two branches of the fork being much thicker, while the short spinules do not give rise to a hair. It is most probable that the caterpillar moves these horns with more or less freedom, and that they are deterrent structures.

On the back of abdominal segments 1–7 are two pairs of dorsal tubercles, those of the anterior pair (*i*) digitiform, as long as the horns are thick; they are separated by a space nearly as long as one of the tubercles themselves. Those of the second pair (*ii*) are a little wider apart, but situated close to the anterior pair, and with shorter and smaller setæ. The presence of a second pair of tubercles on the tergum, the four tubercles arranged in a short trapezoid, is a very primitive feature. I have observed them in the first stage of *Cerura*, *Heterocampa*, *Macrurocampa*, and other Notodontidæ, as well as in *Anisota* and *Adelocephala*, but not in *Eacles*.

The caudal horn is about as thick as the metathoracic horns, the distal half fully as thick through, and the two divisions of the fork are of the same size, including the terminal setæ. It is also equally flexible, and its armature is the same, the surface being beset with microscopic conical spinules which do not end in a hair. The horn is about half as long as the anterior horns, extending a little beyond the end of the dorsal setæ.

The horn is the fused homologues of the anterior pair of tubercles of the abdominal segments in front, for directly behind its base is a pair of short tubercles of the same size and shape as those of the posterior pair.

The ninth abdominal segment is armed dorsally with a pair of separate tubercles like, in shape and size, the anterior ones on segments 1–7, but situated close together at their base. The suranal plate is triangular, about as long as broad, with three small marginal tubercles on each side, and one twice as large near the base of the plate. The surface is not tuberculated. The anal legs are flat, square, not rough and tuberculated, but bearing three small setiferous tubercles near the lower edge.

The tubercles of the subdorsal second row (*ii*) are simple and digitiform, as are those of the third or supraspiracular row (*iii*). These tubercles arise from a broad base, forming a dark or reddish discoloration. The tubercles of the lower or fourth supraspiracular row (*v*, *vi*) are on the abdominal segments united at their base, those of the second and third thoracic segments minute and single, as usual in all Ceratocampidæ.

The setæ are peculiar in the microscopic spinules being stout, conical, often blunt. They are of nearly equal length, the longest one being nearly or about two-thirds as long as the segment is thick, and necessarily add very much to the defensive nature of the armature of the young larva.

The ground color, as shown by Mr. Joutel's drawing, is a reddish ochreous, the bases of the tubercles being surrounded by light reddish brown; the tubercles are all red, the middle of the big two dorsal horns and of the caudal horn being yellowish. There are no longitudinal or transverse stripes.

[ARSENURA POLYODONTA (Jordan).

Rhescyntis polyodonta Jordan, Nov. Zool., vol. 18, 1911, p. 134.—Mexico.]

RHESCYNTIS Huebner.

Rhescyntis Huebner, Verzeichniss bek. Schmett., p. 156, 1822.
Rhescyntis Walker, Cat. Lep. Het. Br. Mus., VI, p. 1320, 1855.
Rhescyntis Kirby, Syn. Cat. Lep. Het., I, p. 745, 1892.

Imago.—Head narrow between the eyes, the sides of the front parallel, the scales close and short, eyes large and full. Antennæ of ♂ very long, composed of about 48 joints, which are short, bipectinate; pectinations moderately long; only the last joint without a short branch; those of the basal and distal pair very close to each other. Palpi large, extending well beyond the front, directed upward; third joint not distinct.

Fore wings very long and narrow, nearly two and one-half times as long as wide, very falcate; costa much arched; apex broad, squarish, outer edge nearly twice as long as the inner. Hind wings *Attacus*-like in shape; outer edge full and rounded, especially toward the inner angle; inner edge very long and straight. The abdomen only reaches to a little beyond the basal third of the hinder edge.

Venation much as in *Arsenura* and *Dysdaemonia*. In the fore wings vein III_1 arises as in these two genera; there is no vein III_2 (so far as I can ascertain); as in those two genera vein IV_2 is detached, becoming an independent vein. In the hind wings the shape of the discal cell, the length of the discal vein and their obliquity is nearly identical with that of *Arsenura*.

Markings: There are no ocelli on either pair of wings, but an apical eye like black spot on the fore wings. The moths of this magnificant genus have been associated with *Attacus* and *Philosamia* since the days of Hübner, but in the venation, the palpi, and the narrow front it is closely related to *Arsenura*.

[Several species, described as *Rhescyntis*, are placed by Kirby in *Arsenura*. In the later writings of Rothschild and Jordan, various species which Kirby lists as *Arsenura* (e. g., *championi* Druce, *hercules* Walker, *sylla* Cramer, *armida* Cramer) are referred back to *Rhescyntis*. *Rhescyntis* as here understood is *Machaerosema* Rothschild. Kirby designates *hippodamia* Cramer as the type of *Rhescyntis*, but Rothschild states that the type is *armida* Cramer, and hence gives a new name to the *Rhescyntis* of Kirby and of the present work. Dr. Dyar informs me that Hübner's *Rhescyntis* included *erythrinae* (=*armida*), *cassandra*, *sylla*, and *hippodamia* in this order. Kirby apparently had a right to designate *hippodamia* as the type, and hence *Machaerosema* is a synonym of *Rhescyntis*.]

Geographical distribution.—Neogaeic, the genus ranging from the Isthmus of Panama to Brazil.

RHESCYNTIS HIPPODAMIA (Cramer).

Plate LXXII, fig. 2.

Phalaena-Attacus [*hippodamia*] Cramer, Papillons exotiques, II, p. 43, Tab. CXXVI, B. 1779.
Phalaena-Attacus [*hippodamia*] Gmelin, Systema Naturæ, I, 5, 2404, 468.
Bombyx hippodamia Fabricius, Species Ins., II, 169, 11; Mantissa Ins., II, 109, 13; Entomologiae Systema, III, 1, 413, 18.
Bombyx hippodamia Olivier, Encycl. méth. Ins., V, 28, 15.
Rhescyntis hippodamia Hübner, Verz. Schmett., p. 156, 1822?
Rhescyntis hippodamia Walker, Cat. Lep. Het. Brit. Mus., VI, p. 1322, 1855.
Rhescyntis hippodamia Kirby, Syn. Cat. Lep. Het., I, p. 745, 1892.
Rhescyntis hippodamia Rothschild, Nov. Zool., II, p. 35, 1895.

Imago.—1 ♂. Body and wings fawn-brown, fore wings with a basal shade formed of two parallel reddish brown curved lines, fading out toward the inner edge. No discal spot or even discoloration. Extradiscal line composed of four reddish brown lines arising close together from near the outer edge and curving around to the middle of the costa, the four lines slightly separating from each other. An apical oblique ocellus more developed and specialized than in *Arsenura* (though the latter is a highly specialized genus); this oval ocellus

is edged externally with pale steel blue; directly on the costa is a secondary linear black spot. Below, at the beginning of the bay or sinus, is an irregular black spot, edged with very few scattered blue scales.

Hind wings with no discal spot. A median brown band curved a little outward on the costa. A marginal curved whitish band beyond which is a deeper fawn-colored wide band, edged heavily with black and tending to divide into rings, a little as in *Rothschildia*. This band reappears beneath, but the other lines are nearly effaced. No discal spots on the under side, though the apical eye like spot reappears.

Expanse of the fore wings, ♂ 180 mm.
Length of a single fore wing, ♂ 88 mm.
Breadth of a single fore wing, ♂ 38 mm.
Length of a hind wing, ♂ 60 mm.
Breadth of a hind wing, ♂ 37 mm.

Larva.—Unfortunately the larva of either species of this genus is as yet unknown.

Geographical distribution.—Central America, British Guiana, Dutch Guiana, and Brazil (Rothschild). Canta Gallo, among the mountains a little north of Rio de Janeiro (Mus. Comp. Zoology, L. Agassiz).

RHESCYNTIS MORTII (Perty).

Saturnia mortii Perty, Del. Anim. Art., p. 159, Tab. 32, fig. 1, 1834.
Rhescyntis mortii Kirby, Syn. Cat. Lep. Het., I, p. 745, 1892.
Rhescyntis mortii Rothschild, Nov. Zool., II, p. 35, 1895.

Geographical distribution.—As observed by Rothschild this species has almost the same range as *R. hippodamia;* it was originally described from southern Brazil, but the Tring Museum possesses one from British Guiana.

[Two other species belong to this genus—*R. norax* (Druce) and *R. hermes* (Rothschild). An allied genus is *Grammopelta* Rothschild, based on *G. cervina* Rothschild, from Peru (Nov. Zool., 1908, pl. XI, fig. 5).]

Rhescyntis norax is in general shape like [*Philosamia*] *cynthia*, but with no ocelli or corresponding spots; basal and extradiscal bands ill defined; no apical ocellus. Two submarginal lines on both wings. [Dr. Packard also adds, "it is an extreme departure from *Attacus* probably," but see the remarks above under the genus *Rhescyntis*.]

GOODIA Holland.

Goodia Holland, Entomological News, May, 1893, p. 177.
Orthogonioptilum Karsch, Berlin ent. Zeitschrift, 1892, p. 501, taf. XX, fig. 1, May 15, 1893.
Goodia Aurivillius, Ent. Tidskrift, p. 246, 1899.

[Dr. Dyar writes that *Goodia* Holland was published at the beginning of May, 1893, while *Orthogonioptilum* Karsch appeared in the part of Berl. Ent. Zeit. dated on cover "mitte mai 1893," and received at Library of Congress July 19, 1893. *Goodia* thus has clear priority.]

Imago.—Head rather prominent; eyes rather large; front of the head only moderately wide and narrowing perceptibly toward the labrum. Antennæ of the male very short bipectinated (about 19 or 20 joints in all), with 13 or 14 joints each bearing two pairs of pectinations; those of the basal and distal pair spreading widely apart from the base and provided with long dense cilia, which are curved at the end; the tip subfiliform, composed of 5–6 joints of which all except the two last bear fine short minute vestigial pectinations, with long crowded cilia. Palpi small and short, not reaching the front; brush like, the scales at the end scraggly and irregular, with no sign of a third joint (probably only composed of a single joint); of the shape and proportionate size of those of *Pseudantheraea* [*Cremastochrysallis*] *arnobia.*

Thorax moderately stout; the collar distinct; vesture of moderate length.

Fore wings about half as wide as long; unusually falcate, the costal edge much arched and almost suddenly bent on the outer fourth; apex unusually sharp; outer edge deeply but not suddenly excavated; inner angle squarish, and the inner edge shorter than the outer.

Hind wings with the costa regularly convex; the apex rounded, though a little angulated; outer edge full and regularly convex; inner edge straight, so that the inner angle is squarish, not rounded.

Abdomen rather slender, not quite reaching the inner angle of the hind wings.

Venation: Very much as in *Rhyscyntis*, the broadly triangular discal cell of the fore wings having the same shape as in that genus; vein II_1 [III_1 in revised nomenclature] arises, much as *Rhescyntis*, quite far from the outer end of the discal cell; II_2 is wanting as in that genus; the venation of the hind wings is also much as in *Rhescyntis;* the two discal veins make an angle, the hinder one being very oblique, directed outward. In all these respects the venation differs from any of the Bunaeinæ, though nearest approach is that of *Cremastochrysallis*.

Markings: Ground color ochreous, a clear small narrow inconspicuous lunate discal spot on the fore wings. Hind wings like those of the anterior pair with no distinct lines; no discal spot above, but a dark solid small one beneath. Its colors indicate that it is protected by its resemblance to a sere faded pale sienna brown leaf.

In its venation, notably in the vein III_3 being so much detached from the subcostal vein, and becoming an independent one, this genus does not belong with the Bunaeinæ, but should provisionally be associated with *Rhescyntis* in the *Agliinæ*. A glance at the figures will show how closely the two genera agree in venation. On the other hand, the ♂ antennæ are very short, and the palpi are very small and short, almost vestigial, as in *Cremastochrysallis arnobia* (Westw.). It will be interesting to see what light a knowledge of the larva and pupa will throw on the affinities of this aberrant and rather highly specialized genus.

Geographical distribution.—So far as known, the species are confined to the region in West Africa in French Congo, near Cape Lopez, about the mouth of the Ogove River.

GOODIA NUBILATA Holland.

Goodia nubilata Holland, Entomological News, IV, p. 178, Pl. IX, fig. 3, May, 1893.
Goodia nubilata Holland, Annals and Mag. Nat. Hist. (6), XII, p. 251, Oct., 1893.

Imago.—1 ♂. Head, body, and wings pale ochreous brown, the head in front, breast, and legs darker with a reddish ochreous tint. Collar and costal edge of fore wings whitish gray or hoary. No distinct lines or bars, but the wings are variously spotted and mottled with sienna-brown. A fine brown curved basal line, which is reddish, ending near the inner third of the inner edge of the wing. Extradiscal line obscure, scalloped, marked by brick-reddish distinct points on the veins. Discal spot indistinct, not easily seen, small, narrow about three times as long as wide, and finely edged with dark-brown scales. Edge of wing pale reddish brown; a large pale cloud between the discal spot and the outer edge.

Hind wings like the fore wings, but more ochreous; no basal line. A zigzag submarginal line chiefly indicated by the emphasized dark points of the scallops.

Beneath much as above, but the discal spot a little more readily seen, and on the hind wings there is a dark-brown line; a small distinct lunate, somewhat angular, discal spot. There are no distinct lines.

Expanse of fore wings, ♂ 70 mm.
Length of a single fore wing, ♂ 35 mm.
Breadth of a single fore wing, ♂ 19 mm.
Length of hind wing, ♂ 24 mm.
Breadth of hind wing, ♂ 19 mm.

This species has been described from the type specimen very kindly loaned by Dr. Holland, director of the Carnegie Museum at Pittsburgh, Pa. It appears to differ from *G. impar* Aurivillius in the hind wings not being so much produced behind; the fore wings are more acute; there are no spots near the clear discal one; and the wings beneath show no violescent shade.

Geographical distribution.—Collected by Rev. A. C. Good at Kangwe, Ogove River, West Africa. French Kongo, a little south of Cape Lopez, latitude 2° S. (about).

Dr. Holland states that the female differs from the male in having the antennæ very slightly pectinated and quite short, the fore wings relatively broader, with the outer edge rounded from the outer angle and very slightly produced at the apex.

Originally referred by Holland to the Drepanulidæ, the genus was placed in the "Saturnidæ" by Karsch. [More recently (1909) *G. septiguttata* Weym. has been described from East Africa and *G. oriens* Hampson from Ruwenzori.]

DYSDÆMONIA Hübner.

Dysdæmonia Hübner, Verzeichniss bek. Schmett., p. 151, 1822.
Dysdæmonia Walker, Cat. Lep. Het. Br. Mus., VI, p. 1328, 1855.
Dysdæmonia Maassen and Weymer, Beiträge Schmett., I, 1869.
Dysdæmonia Felder, Reise der Novara, Lep., IV, 1874.
Dysdæmonia Kirby, Syn. Cat. Lep. Het., I, p. 768, 1892.

Hübner had only one species under *Dysdæmonia, D. boreas* (Cramer).

Imago.—♂ and ♀. Head moderately prominent; eyes rather large. The front is square, though longer than wide, while the squamation is close, the scales appressed to the surface. The male antennæ are very peculiar, being long and narrow; the joints are longer than thick; and the distal pectinations are absent; the basal ones very short and broad, obtuse at tip, the outer ones much longer than those on the inside, which are simply short blunt teeth; they are densely ciliated, the long cilia spreading out above, beneath, and at the ends. The ♀ antennæ filiform, simple, with a minute tuft of cilia on each side of each joint. Palpi very distinct, as the scales on the under side of the head and thorax are short; they extend a little beyond the front and slightly ascend; the third joint is not distinct from the second and is quite small. The maxillæ are well developed, and, what is unusual in the group, united at their base; and though very slender, coiled up between the palpi, they are about one-third as long as the ♂ antennæ. The thorax is rather stout, and the scales short.

Fore wings large and broad with the costa straight at base, but well arched toward the apex, which is elongated, squarely docked, and the outer edge deeply excavated and scalloped; in the ♀ the broad apex is shorter and the outer edge less deeply excavated than in ♂. Hind wings rectangular at apex; the middle of the outer edge is drawn out into a rather long square-tipped tail, which in ♀ is much longer though no wider, being nearly as long as half the breadth of the wing. Abdomen of ♂ rather more regularly conical than usual. Costal region wider than in *Arsenura.*

Venation: Approximates to that of *Arsenura;* vein III_1 arises at the same distance within the discal cell; but III_2 is wanting, showing a reduction and aberration; vein IV_1 originating as in *Arsenura;* vein IV_2 arising in the middle, so that the cells on each side are of the same width; the discal veins each curved, so that the common line made by the two is a distinctly sinuous one. Hind wings with the same general arrangement of veins as in *Arsenura* but the anterior discal vein is straight, not curved, and extends very obliquely to origin of vein III_2, and the posterior discal vein is not oblique but regularly curved.

Markings: The genus may be at once recognized by the two twin regularly oval clear spots on the fore wings at the end of the discal cell. On the hind wings is a minute indistinct clear round spot; both wings are crossed by three dark lines which radiate from near the inner angle of the wings. Ground color fawn brown, the color of the elk and deer, also leaf brown. Both sexes have the same shades and style of markings.

Larva.—Body smooth, unarmed, somewhat as in *Aglia tau;* the head and first two thoracic segments small; the metathoracic segment large and swollen.

The genus is marked by the tailed wings in both sexes, but also by the peculiar antennæ, which suggest the Sphingid type by their very short pectinations which are ciliated, as do also the coiled, though slender and small maxillæ. In no other genus are there two twin oval spots, one discal, the other in the cell in front. In its colors and tailed wings the moths probably are mimetic and could be mistaken for a dead dry leaf with its stalk. It is allied to *Arsenura,* the venation not being very different in the two genera.

In the shape of the head and coloration, the fine close vestiture of the body, and the angulated wings and venation, the genus comes near *Arsenura,* from which, or some allied form, it may have originated; its greater degree of specialization is seen in the short "tails" and the

singular twin discal spots. It is possible that *Copiopteryx* with its very long tails is an extremely specialized *Dysdæmonia*. It has no near relationship to *Eudæmonia*.

Geographical distribution.—A member of the Neogæic fauna, extending from Vera Cruz, Mexico, to Brazil.

DYSDÆMONIA BOREAS [Cramer] Hubner.

Phalæna-Attacus boreas Cramer, Papillons Exotiques, I, p. 110, Pl. LXX, B. 1774.
Dysdæmonia boreas Hubner, Verzeichniss bek. Schmett., p. 151, 1822 (?).
Dysdæmonia boreas Druce.
Dysdæmonia boreas Kirby, Syn. Cat. Lep. Het., I, p. 768, 1892.

LARVA.

Peters, H. T., Die Heteroceren Raupen, p. 9, Pl. III, fig. 9, pupa, 9a (reduced), (a very brief description of colors only).

Imago.—1 ♂, 1 ♀. General color of thorax, abdomen and wings fawn or elk brown, or color of a dead brown leaf, being of a pale umber, with a hoary or frosted tint. Head, palpi, fore legs and breast chocolate. Antennæ pale, the joints dark.

Fore wings with three narrow brown lines diverging from near the inner angle, the basal one arising somewhat beyond the middle of the inner edge, and passing in a slightly curved direction to the inner fourth of the costal edge; the extradiscal and submarginal lines arise close together near the inner edge and diverge a little, the inner passing close to the discal spots and the submarginal, parallel with the outer edge and near the costa, bent at a right angle onto the costa, approaching the costal end of the extradiscal line. The edges of the wings are only slightly darker brown than the middle of the wing. There are faint traces of a very diffuse dark shade between the basal line and the discal spots. Two conspicuous rather large clear discal spots at the end of the discal area, and separated by a vein; they are regularly oval, the larger end looking toward the base of the wing and bordered with chocolate brown, more narrowly so on the outer end. Outer edge of the wing with the apex broad and square, and the deeply excavated outer edge below the broad square elongated apex is divided into four scallops.

Hind wings with three lines as in the fore wings, but the third or outer one is curved around, ending at the base of the tail. A small round inconspicuous discal clear spot. Underside of the wings slightly paler than above, the submarginal line is not repeated, but the two inner ones are distinct, and the twin discal spots are not bordered with chocolate in either sex.

Expanse of the fore wings, ♂, 117 mm.; ♀ 130 mm.
Length of one wing, ♂, 63 mm.; ♀ 70 mm.
Breadth of one wing, ♂, 33 mm.; ♀ 38 mm.
Length of hind wing, including tail, ♂ 61 mm; the tail alone, 18 mm.; width of tail at end, 7 mm.
Length of hind wing, including tail, ♀ 56 mm.; the tail alone, 10 mm.; width of tail at end, 8 mm.
Length of an ocellus, 6 mm.

A very interesting and peculiar form, the leaf-brown color, the tattered and torn ragged outer edge of the wings, and the tailed hind wings, evidently make it a mimetic form, reminding one of the *Kallima* butterfly.

Larva.—Peters states that "the third segment of the body is swollen or humpbacked; that the body is green, often ornamented with violet."

Judging from his figure the body is smooth, unarmed with either spines or tubercles; his drawing showing no traces of any kind of armature. The body tapers to the anal legs, which seem to be much smaller than usual; the suranal plate not being prominent. On the other hand the third thoracic segment is very large, much swollen and bulging out in front on each side. The first and second thoracic segments, as well as the head, are small; the second segment about half as wide as the third, and these two segments, with the head, are probably, when the creature is alarmed, retracted within the third segment.

As the caterpillar is not rare in the neighborhood of Rio Janeiro, it will be most desirable to discover the larva in its first stage and see how it compares, as it probably does closely, with that of *Arsenura* in its first stage.

Pupa.—Peters represents the pupa as of the Sphingicampid shape; the head end not much rounded, but the other end of the body ending in a spine or cremaster of moderate size.

Food plant.—Ascending to Peters the larva lives on the beautiful well-known Paineira.

Geographical distribution.—Vera Cruz, Mexico (Franck); Brazil, Peters says "it is not rare near Rio, where the gray, tailed moth grows larger than in the mountains." Cramer gives "West Indies" as its habitat. [Rothschild (1907) has described a subsp. *brasiliensis* from Brazil.]

DYSDÆMONIA KADENII (Herrich-Schaeffer).

Eacles kadenii Herrich-Schaeffer, Sammlung aussereur. Schmett., p. 61, ♂, fig. 444, 1855.
Dysdæmonia kadenii Kirby, Syn. Cat. Lep. Het., I, p. 768, 1892.

In the shape of the antennæ and wings, and the tail of the hind wings this, judging from Herrich-Schaeffer's figure, is congeneric with *D. boreas*, but there are no clear spots or any kind of discal spots on the fore wings, though the lines or shades are much as in *D. boreas*.

DYSDÆMONIA TAMERLAN Maassen.

Plate CXIII, fig. 2.

Dysdæmonia tamerlan Maassen, Beitrage Schmett., I, fig. 10, 1869.
Dysdæmonia tamerlan Kirby, Syn. Cat. Lep. Het., I, p. 768, 1892.
Dysdæmonia tamerlan Rothschild, Nov. Zool., II, p. 48, 1895.

Imago.—1 ♂. This species is larger than *D. boreas*. The antennæ and palpi are the same as in that species, though the latter are slightly stouter and extend farther beyond the front of the head. Fore and hind wings of the same shape, but the tail is not quite so long and is decidedly broader. The ground color is light fawn-brown while *D. boreas* is gray or somewhat hoary. In the fore wings the lines and the two clear discal spots are as in *D. boreas*, but the basal line is less distinct. The sinuses on the outer edge of the wings are deeper than in *D. boreas*. A large triangular costo-apical spot. Beneath uniformly ochreous-fawn, the extra-discal line forming a dark shade.

Expanse of fore wings, ♂, 142 mm.
Length of a fore wing, ♂, 75 mm.
Breadth of a fore wing, ♂, 40 mm.
Length of hind wing, ♂, 75 mm., including the tail, which is 12 mm. long.
Breadth of hind wing, ♂, 37 mm.

Rothschild states that "A great amount of variation is shown in *D. tamerlan* Maass., both in size and tint, which latter varies from warm gray to chestnut."

Geographical distribution.—Brazil (Neumoegen coll. in Brooklyn Museum).

DYSDÆMONIA GLAUCESCENS Walker.

Dysdæmonia glaucescens Walker, Cat. Lep. Het. Br. Mus., VI, p. 1328, 1855.
Dysdæmonia glaucescens Kirby, Syn. Cat. Lep. Het., I, p. 768, 1892.

Imago.—"Female, brown, antennæ testaceous. Fore wings obscurely glaucous, with brown streaks, and with a blackish blue-speckled band, which disappears toward the costa and joins the interior border at two-thirds of the length of the latter; the streaks between this band and the base of the wing are transverse, but the exterior streaks are parallel to the length of the wing; exterior border with a deep notch between two shallow excavations, somewhat angular in front. Hind wings pale brown toward the base, and with an angular pale brown exterior band; exterior border with two broad shallow excavations; tails short, acute, parallel to the length of the wing. Length of the body 17 lines; of the wings 62 lines."

Geographical distribution.—Brazil (Saunders collection).

DYSDÆMONIA ARISTOR (Felder).

Aricia aristor Felder, Reise d. Novara, Lep., IV, Tab. 91, fig. 3, ♀, 1874.
Dysdæmonia aristor Kirby, Syn. Cat. Lep. Het., I, p. 768, 1892.

[*Geographical distribution.*—Surinam.]

[Rothschild makes this a synonym of *D. boreas.*]

DYSDÆMONIA PLUTO (Westwood).

Saturnia ? pluto Westwood, Ann. & Mag. Nat. Hist., ser. 2, XV, p. 301, 1855; Proc. Zool. Soc. London, 1853, p. 164.
Dysdæmonia ? pluto Walker, Cat. Lep. Het. Br. Mus., VI, p. 1330, 1855.

Walker states: "This may be a variety of *D. glaucescens.*"

Geographical distribution.—Venezuela (Walker, British Museum). [Brazil, Rothschild.]

[Rothschild (1907) has described a subsp. *andensis* from Peru.]

[Other species of *Dysdæmonia* are *D. platydesmia* Rothschild, 1907 (Peru), with subsp. *castanea* Roth., 1907 (Costa Rica); the latter figured in Nov. Zool. 1908, Pl. XI, f. 10; and *D. lemoulti* Schaus, 1905 (French Guiana).]

AGLIA Ochsenheimer.

Plate LXXXIV, fig. 4: CIII.

Aglia Ochsenheimer, Schmett. Eur., III, p. 11, 1810.
Echidna Hübner, Tentamen, p. 1, 1810?
Aglia Hübner, Verzeichniss bekant. Schmett., p. 152, 1818 or 1822.
Aglia, Walker, Cat. Lep. Het. Br. Mus., VI, p. 1313, 1855.
Aglia, Kirby, Syn. Cat. Lep. Het., I, p. 783, 1892.

Imago.—♂ and ♀. Head not prominent, in ♀ much less than in ♂; front moderately wide, of much the same proportions as in *Arsenura* and *Dysdæmonia.* The sides between the eyes parallel, not converging toward the labral region; the hairs standing straight out, long and fairly even; when denuded the front or clypeus is but a little longer than wide, nearly square. The eyes are rather small.

Antennæ of ♂ consisting of 40 joints, 39 of which bear each two pairs of pectinations, which extend to the penultimate joint, very widely and evenly branched so that they are between one-half and one-third as wide as long; the distal branches are very slender, pressed against the basal ones of the succeeding joint, and a little shorter than the basal ones, all the branches with long sparse cilia. In ♀ the basal branches reduced to minute stout teeth; no vestiges of the distal ones.

Palpi large, unusually well developed, ascending and passing well beyond the front, farther than usual, except in *Arsenura* and *Dysdæmonia;* the third joint large, well developed, and unusually distinct; when denuded, the second joint is seen to be much longer, nearly twice, than the basal joint. The maxillæ with no vestiges unless two microscopic tubercles represent them, at all events they are still more vestigial than in *Arsenura.*

Wings of both sexes very similar in shape, though the ♀ hind wings are perhaps a little more produced toward the apex; fore wings moderately wide, costa straight, arched toward the subacute apex; slightly subfalcate; outer edge very slightly excavated. Hind wings in each sex reaching well beyond the end of the abdomen; they are rounded at the apex, outer edge full and well rounded, the inner angle rounded.

Venation: Vein III_1 arising close to the common stalk of veins III_3 and III_4, and both points of origin situated just within that of the anterior discal vein, which is oblique, thick, and throws off the independent (vein IV_2), near the middle of the extradiscal cell, but not exactly in the middle, as occurs in *Arsenura* and *Dysdæmonia.* The rest of the discal vein (posterior one) is divided into two curved separate veins, giving off a slight short fold (or incipient vein) passing outward. No vein III_2. Hind wings with an arrangement of veins approaching that of *Arsenura* and *Dysdæmonia,* though quite distinct. It agrees in the discal veins, together forming an oblique line, so that the general shape of the discal cell is the same, the outer side being very oblique; in *Aglia* vein IV_2 is not quite so near the middle of the

extradiscal cell as in the two other genera named; on the whole *Aglia* approaches nearest to *Arsenura* in venation, though the discal vein (or end of the discal cell) is exactly in the middle of the wing, owing to the wing not being produced, while in *Arsenura*, and more especially in *Dysdæmonia*, the outer portion of the wing is so produced or developed as to make the discal cell appear very small and but little more than a third the length of the wing. [On the margin is a pencil note.] Thus *Aglia* is nearest to South American genera. [Compare?] *Bathyphlebia.*

In the venation *Aglia* also approaches *Urota*, i. e., in the ramification of the "subcostal" (radius) vein III_2, those of the common stalk of III_1 and III_2 is long in *Urota*, in *Aglia* there being no such stalk; in the mode of origin of the independent vein IV_2, while in the venation of the hind wings there is also, in the essential features, a marked resemblance to *Urota;* thus the origin of the veins IV_1 and IV_2 are much the same, the latter (independent) being detached and assuming nearly the same position in the discal cell; the two discal veins taken together forming a line of the same degree of obliquity, so that the shape of the discal cell is the same in both genera, and though the ♂ *Urota* is tailed, the end of the discal is near the middle of the wing (in the longitudinal sense); in ♀ *Urota* the venation (involving the length of the vein) is remarkably similar to that of *Aglia*, the branches of the radius (III) and median or cubitus (IV_3 and V_1, V_2) being very similar, as well as the disposition of the two discal veins taken together.

The resemblance to the South American *Eudelia*, as regards venation, is much less marked.

Legs unusually long and slender, not very densely scaled, and with two small unequal spines on the hind tibiæ; the fore tibiæ rather long and slender; the tibial epiphysis is covered with hair-like scales, there only being a bare space on the inside near the end; it is unusually long and large in proportion to the tibia, being about three-fourths as long as the tibia, narrow, flat, the end widened, not pointed.

Markings: The ground color of the body and wings is a dull ochreous-fawn, with a heavy dark-brown submarginal line common to both wings, an incomplete or rudimentary ocellus in each wing, being a dark blotch centered by a white ⊤, the shaft of the ⊤ pointing inward and no longer than the cross; the ⊤ is more regular and decided in the ♀. On the under side of the fore wings the ⊤ is more marked, the shaft triangular; on the hind wings forming an irregular conspicuous triangular spot, rather than a ⊤; the hind wings are also suffused with rich brown and gray.

Genitalia: A single pair of unusually large claspers nearly as long as abdominal segments VII–IX together, very wide and convex externally, and ending within in a small obtuse projection, not forming a true spine. Suranal plate broad, curved downward and inward at the extremity, which is forked, black, solid, densely chitinous. Compared with *Polythysana*, the suranal plate is of nearly the same type, being a broad concave plate narrowing behind where it curves downward and is forked at the end; but there is but a single pair of claspers, and they are much simpler in structure, though larger, and not ending in a true hook, nor is there present the upper pair of claspers, which are so marked in *Polythysana.* The penis is slender, style-like, and the accussory part is triangular; these parts being much as in *Anisota.*

Aglia appears to be a genus which has perhaps by migration to Asia and finally to eastern and central Europe, been cut off from its ancestral forms and adapted to a cool moist climate. The wings are of simple outline, without any tendency in the anterior pair to become falcate, or in the hinder pair to become tailed, or if not tailed, angulated. The ocelli are alike in shape and color on the wings of each pair, though those of the fore wings are smaller. The coloring of the wings is less vivid and striking than in *Polythysana.* Its general similarity in size, shape of body and wings, and in markings, to the smaller kinds of *Saturnia* has led to its being regarded as a Saturnian.

Egg.—Poulton describes the egg as being of very large size, about 2.5 mm. by 1.9 mm.; and as rather flattened on the upper surface with a slight central depression. The shape, he adds, is very like that of *Smerinthus* or *Sphinx*, but the size is somewhat larger. It is dark brown and laid upon bark. He obtained about 60 eggs from a single ♀ paired in confinement.

Larva.—Stage I: For our knowledge of this stage we are indebted to Mr. Poulton's careful description and excellent figures.

Length, 6.25 mm.; at the end of the stage, 10–11 mm. Head green and rounded. The ground color dark green; along each side a white subspiracular line ending in front on the base of the prothoracic spine, and behind ending at the base of the red terminal suranal spine. There are seven complete oblique lateral white stripes sloping in a posterior, a direction the reverse of that of most Sphingidæ, though in *Sesia* there are similar reversed stripes. The two prothoracic dorsal are slightly shorter than the metathoracic dorsal horns, but are much as in stage III and all a little longer, but otherwise like the caudal horn; all are bright red. He describes the head as very generalized, and like that of the young form of *Smerinthus* and *Sphinx*. The length of the stage is unusually long, i. e., 16 days.

Stage II: Length 10.5 mm.; at end of the stage 15.5–17 mm.; color and marking almost identical with those of the previous stage, and the terminal fork on the five spines not so marked in this stage, and it becomes less so in the next, the fork being entirely absent in the last stage and often in stage II. Length of stage about nine days.

Stage III: Length 16 mm.; at end of the stage 22.25–27 mm. Differs but slightly in color or armature from stage I. "The anal red spine is relatively shorter and less conspicuous" (Poulton). A blown larva 23 mm. in length, and evidently in stage III, I have received from Staudinger-Bang-Haas.

Prof. Poulton does not enter into details regarding the armature. Notable features are the two great prothoracic horns, the minute mesothoracic ones, the very large metathoracic ones, also beside the large caudal horn, the pair of small short spines on the distinct ninth abdominal segment, the tubercle i of this segment being obsolete, while the suranal plate bears in its middle a pair of similar spines, the plate itself ending in a long somewhat upturned conical projection, extending well beyond the anal legs. Tubercles ii are wanting on the thoracic and abdominal segments, at least I have been unable to detect them, while the two tubercles on abdominal segment 9 are presumably ii. The two minute tubercles i on the mesothoracic segment are scarcely higher than thick. Those of abdominal segments 1–7 are of uniform size, being small and slender and ending in a short seta. The caudal horn is more deeply forked than the thoracic ones. The suranal plate is regularly triangular, a little longer than broad. The anal legs are large and rounded. The body is clothed with numerous fine microscopic secondary setiferous tubercles.

Stage IV: As observed by Poulton, *Aglia* is remarkable for passing through but four larval stages.

Length 24–25; at the end of the stage 45 mm. The stage lasts from 10 to 12 days, the whole larval life in England extending from 42 to 44 days.

The larva has now lost all its spiny armature, the shagreen dots, oblique stripes, and subspiracular line remaining. "The whole anterior part of the larva," says Poulton, "is not unlike a caricature of a vertebrate head, with the terrifying marks in the appropriate position for eyes."[1]

Prof. Poulton comes (1888) to the following results from his study of the ontogeny of this insect. He shows the resemblance to the larvæ of the Sphingidæ in 15 points, also noting the differences, such as the presence of the four thoracic horns and caudal horn in all but the last stage. He compares the armature with that of certain Ceratocampidæ, also *Rhescyntis*.

He concludes that "the Sphingidæ are a specialization of the group of Saturnian Bombyces, and that the following order represents the nearest affinity, and is an approach toward the expression of genetic relationship: *Sphinx, Acherontia, Smerinthus, Ceratomia, Lophostethus, Aglia, Ceratocampa, (Attacus), Saturnia.*"

[Since the above was written, *Aglia tau* has been made the subject of much experimental research by Standfuss and others, on account of its remarkable variations, which are of great

[1] The transformations of *A. tau* were originally described and figured by Duponchel et Guénée (Iconographie, ii). In 1863, from an examination of the figures, my attention was attracted to the singular changes of the larva, and I compared the young larva to the fully grown caterpillar of *Citheronia regalis*, afterwards, and pointed out that the latter genus was an "embryonic form and therefore inferior in rank to the *tau* moth." Amer. Naturalist, June, 1870, and Our Common Insects, p. 52.

interest to students of heredity. Several of the forms have received names, as *melaina* Gross, *cerberus* Schultz, *ferenigra* Thierry-Mieg, *ferecaeca* Oberth., *uniformis* Oberth., etc. A race from Japan has been described as *japonica* by Leech, while one from west China has been named *homora* Jordan. The variety *lugens* Standf. is identical with *ferenigra*, according to Jordan.]

[The following general discussion of the affinities of *Aglia* appeared in Proc. Amer. Philosophical Society, XXXI (1893), pp. 139–141:]

Aglia tau, a connecting link between the Ceratocampidæ and Saturniidæ and the type of a new subfamily, Agliinæ. In this European Bombycine moth we have surviving, side by side with the generalized Saturnia, a most interesting form, which is a Ceratocampid in its earlier larval stages, the larva in its last stage and the moth being very near the Saturnians, although it does not spin a cocoon, and should be regarded as a Ceratocampid. We could not have any clearer demonstration of the origin of one family from another by direct genetic descent.

The transformations of this form, originally figured in Duponchel et Guénée's *Iconographie* [1] (Tome II), has been more fully elaborated by Mr. Poulton.

Having received, through the kindness of Dr. Heylaerts, a young larva of *Aglia tau* in its third stage, I have been able to compare it with *Eacles imperialis* in its third stage, a thing Mr. Poulton could not do for want of specimens. The resemblance between the two genera at this stage is most striking, although the fully fed larvæ are so different, *Aglia* passing at a single molt (the third and last, this larva only having *four* stages), from one family to another! We know of no parallel case, or at least of one so very striking and conclusive.[2] Thus the ontogenetic development of this caterpillar epitomizes that of two families, whereas that of most Bombyces is simply usually only an epitome of that of a subdivision of a family, or of a small group of genera.

Aglia tau in its third stage differs from *Eacles imperialis* in its third stage in having a pair of dorsal "horns" on the first and third thoracic segments, where *E. imperialis* has only minute ones on the prothoracic segment, while those on the second thoracic segment are as well developed as those on the third segment; those on the second segment are minute; all the "horns" are forked as in *Eacles*. The dorsal spines on the abdominal are simple and minute, like those on the second thoracic segment. The shape of the head and of the anal legs is much as in *Eacles*, but the suranal plate differs strikingly in being produced into a rather large, spinulated spine, a feature not known to exist in any Ceratocampids.

It should be observed in regard to the large size of the prothoracic horns of *Aglia*, that those of *Citheronia regalis* are quite well developed, being about two-thirds as long as those on the two succeeding segments.

Upon examining the adult of *Aglia*, I find that its head and antennæ are closely similar to those of *Hyperchiria* [*Automeris*] *io*, and the Hemileucidæ in general; the antennæ form a close approach to those of *H. io*, as on careful examination with a good lens a second branch of the pectinations of the male antennæ can be perceived; it forms a long, separate branch, but is in the dead and dry specimens very closely appressed to the anterior main pectination. In the venation of both wings *Aglia* shows a most unexpected resemblance to that of *Eacles imperialis;* like that and other Ceratocampidæ and the Hemileucidæ, having five subcostal branches, while in the Saturniidæ there are only four, the first one wanting in the latter family.

Thus the moth belongs with the Ceratocampidæ, while the larva after the last molt loses all its spines and becomes very much like a Saturnian, perhaps of the type of *Telea*, though it is without tubercles or spines, and especially like a smooth form, the larva of *Attacus betis* Walker, figured by Burmeister in his *Atlas of the Lepidoptera of the Argentine Republic*. We therefore suggest that *Aglia tau* should be regarded as the type of a distinct subfamily of Ceratocampidæ, and thus the latter group may be divided into the two subfamilies Ceratocampinæ and Agliinæ.

At present both from their larval and their imaginal characters, and in their spinning a cocoon we are disposed to consider the Hemileucidæ as a family closely allied to, though distinct from, the Ceratocampidæ.

On examining the European genus *Endromis*, we are disposed to think that the family Endromidæ is a natural one. It would, however, be a violation of the principles of classification to include *Aglia* with it. The two genera, both as regards their larval and their adult characters, are quite distinct. I find that *Endromis versicolora* has the head, palpi, and antennæ and the hairy abdomen very closely like those of our *Hemileuca maia*, but the median vein of both wings divides into four branches, and the subcostal vein of the four wings divides into five branches, as in *H. maia* and the other Hemileucidæ. Judging by the colored figures of the larva in European works, the larva of *Endromis* is smooth, with a small retractile head, oblique bars, and a conical caudal horn. The group Endromidæ is a branch of the Bombycine tree, parallel to but distinct from the Hemileucidæ, and stands above the latter, connecting the group and the Ceratocampidæ and Saturniidæ with the higher families of the Bombyces, in which there are four branches of the median vein, all the families mentioned agreeing with the Notodontidæ in having but three. In its general shape, the small retractile head, the mode of coloration, and the caudal horn, the larva of *Endromis* appears to be remarkably near the Sphinges. Buckley describes the cocoon as "composed of an open-worked reticulation of coarse

[1] Guénée states that after attaining its full size, "Elle se retire à la surface de la terre, entre des mousses et des débris de végétaux qu'elle attache avec de la soie, et elle s'y change en une chrysalide grosse, courte, d'un brun foncé saupaudré de grisâtre, et dont l'anus est terminé par une faisceau de pointes recourbées."

[2] Over 20 years ago, in 1863, when first beginning my studies on the Bombyces, my attention was attracted to the singular changes of *Aglia tau* and I compared the young larva to the full-grown larva of *Citheronia regalis* and pointed out that the latter genus was an "embryonic form and therefore inferior in rank to the Tau moth." (Amer. Naturalist, June, 1870, and Our Common Insects, 52.)

black or black-brown silk threads, with round or broad oval interstices, as the fabric is extremely strong, tough, and elastic, covered externally with moss and birch leaves firmly adherent" (III, 65).

It is interesting that in the transformations of *Rhescyntis erythrinæ*, as figured by Burmeister, we have a parallel to the case of *Aglia tau*. The fully grown larva is smooth-bodied and without the four long large thoracic spines, and the caudal horns on the eighth and ninth abdominal segments of the previous stage. The genus appears to belong to the Ceratocampidæ.

Although we are not yet acquainted with the early larval stages of *Endromis*, we do not see why the Sphingidæ may not have sprung from a form like this as much as from *Aglia*, as the shape and markings of the full-grown caterpillar are much nearer a typical *Sphinx* than those of *Aglia*. Moreover, taxonomically, *Aglia* is by no means so "closely" allied to the Sphingidæ as Mr. Poulton in his able papers would lead us to infer. In its venation *Endromis* is much nearer, and the latter is a more generalized or synthetic form than *Aglia*. From the Ceratocampidæ the families of Saturniidæ and also of Hemileucidæ may have originated, and indeed all the Bombyces, unless we accept the Arctians and Lithosidæ, may have evolved before the Sphingidæ appeared. Judging by the characters of the head, the antennæ, throax, and especially the venation, the Sphingidæ are far removed from the Ceratocampidæ, and their origin from the latter family was at least remote, and there must be some lost, extinct annectant forms which originally connected them.

POLYTHYSANA Walker.

Polythysana Walker, Cat. Lep. Het. Br. Mus., VI, p. 1314, 1855.
Polythysana Kirby, Syn. Cat. Lep. Het., I, p. 785, 1892.

Imago.— ♂ and ♀ head very small, eyes of moderate size, rather small. Front of the head moderately wide, and with a shaggy vestiture. ♂ antennæ widely pectinated, almost plumose; the joints rather long and slender, those near the base longer than thick, those toward the tips nearly three times as long as thick; the basal pectinations very long and slender, densely ciliated; the distal ones a little shorter than the basal ones, but similarly ciliated. ♀ antennæ with short basal pectinations which are rather thick, about twice as long as the joints in the middle of the antenna; the outer distal pectinations about one-third as long as the basal ones, those on the inside vestigial, like minute teeth. Palpi small, short, drooping, not reaching the front; they are rough and shaggy; third joint small, not visible. Thorax with vestiture rough and shaggy, and with the abdomen bearing long, scattered, coarse, but not flattened scales.

Fore wings eminently falcate, especially in ♂, in ♀ slightly so; costa moderately arched; apex squarish, truncated; behind the square apex the outer edge is considerably excavated. Hind wings with the apex well rounded, outer edge moderately full and convex, especially in ♀. The abdomen does not reach to the end of the hind wings in ♂, but it does in the ♀.

Venation: Vein III_1 arising not far beyond middle of the discal cell; vein III_2 wanting; vein IV_2 independent, its origin moved toward middle of discal cell; origin of IV situated midway between those of III_1 and III_4. In hind wings discal cell very long, the discal vein situated unusually near the outer edge, on outer third of the wing. Veins III, IV, and IV_2 arising at equal distances apart; IV_2 and IV_3 being very short, only one-third as long as the wing itself.

Markings: Rather striking, the ground color bright yellow and rose in ♂, with olive-green hues in ♀. The distal spots forming large compound ocelli in the wings of both pairs; they are centered with a linear white crescent. The basal line on the fore wings is broad and distinct. A distinct submarginal deeply sinuous dark line, and an apical roseate spot.

Genitalia: Suranal plate triangular, broad at base (forked at the end; two partially differentiated pairs of claspers, those of lower pair sickle shaped; the large convex and ending in a long sharply incurved acute point; those of the upper small, bearing on the inner edge two thumb-like processes. The suranal plate is triangular at the end, and the incurved tip is divided into two blunt black forks. The penis is acute, style-like, slender, and there is a small rounded triangular plate above it.

This is a very distinct and easily recognized genus, though one difficult to locate, and it is provisionally left in this group; the broad plumose ♂ antennæ (in ♀ with short branches) and the square apex of the falcate fore wings, together with the very large and perfect ocellus in each wing, are characteristic marks.

The larva is thus far unknown.

Geographical distribution.—Neogaeic realm. The species thus far known are confined to Chile. [According to Kirby *P. rubrescens* also occurs in Peru.]

Wings more rounded, less falcate; ocellus oval.....*P. cinerascens.*
Basal line curved; ocellus large, oval, sinus on vein VI deep; hind wings not rosy.....*P. rubrescens.*
Basal line sharply bent; ocellus large, round; sinus deeper still; hind wings rosy at base.....*P. andromeda.*

POLYTHYSANA CINERASCENS (Philippi).

Attacus cinerascens Philippi, Linnaea Ent., XIV, p. 278, 1860.
Polythysana cinerascens Maass and Weymer, Beitr. Schmett., III, fig. 39, 1872.
Polythysana apollina Felder, Reise d. Novara, Lep., IV, Taf. 87, fig. 2, 1874.

Imago.— ♂. Judging by Felder's figure of a ♂, this species differs from the two others (*P. rubescens* and *andromeda*) in the fore wings being a little less falcate, and the hind wings less angular, the outer edge being fuller, more rounded. From *P. andromeda* it also differs in the ocelli of the fore wings being oval, i. e., wider than long, the longer axis extending across the wing; also in having no basal line on the hind wing.

One ♀. Compared with a ♀ *P. andromeda* of nearly the same shape, the fore wings are broad and but slightly falcate. The hind wings are well rounded; the apex full, rounded, and the outer edge full, convex. The thorax and abdomen are not quite so shaggy as in *P. andromeda*. Head in front of moderate width, much as in *P. andromeda*.

Body and wings reddish brown, especially those of the hinder pair. Fore wings reddish brown, the surface in the middle and on the costal edge frosted with whitish pink scales. Basal line broad, heavy, reddish brown, curved, rather than suddenly bent as in *P. andromeda*, near the hinder edge of the wing, and passing very near the ocellus, nearer than in *P. andromeda*. The outer or submarginal line distinct, sinuous as in the other species, but the two scallops on vein Cu_2 are less deep and marked than in ♀ of *P. andromeda*. The line is deep reddish brown, edged externally with whitish pearl gray. Ocellus smaller and more oval than in *P. andromeda*, its axis transverse to the wing, being longer than the longitudinal axis, or along the length of the wing; an outer submarginal deep rich madder-brown broad ring; within this ring a much broader deep snuff-yellow ring, while the oval center is of the same color, but with a few central whitish scales, the inner side of the central area being bounded by a curved fine whitish hair line.

Hind wings of a soft delicate uniform roseate brown hue; the wing smoky at the base, and the extradiscal line or band is broad, smoky brown, fading out toward the ocellus, and situated farther from that spot than in ♀ *P. andromeda;* this line is a little less sinuous than in the latter species.

Underside of fore wings; no basal line; submarginal line blackish, diffuse, becoming narrow and nearly obsolete before reaching the apex of the wing. Discal spot large, not quite round, somewhat oval, deep rich rose-red surrounded by a broad black ring, hind wings uniformly of a solid fawn brown; the ocellus faint, only the short curved fine white line distinct, while the outer line is very indistinct. Abdomen and underside of the body fawn-brown, while the tibiæ and tarsi of all the legs are black brown. It differs entirely from *P. andromeda* ♀ in the rose-red ocellus (this being black in that species), and in the uniform fawn-brown color of the wings, the fore wings being a little dusky at base.

Expanse of wings, ♀ 106 mm. (in ♂, judging by Felder's figure, 82 mm.).
Length of one fore wing, ♀ 52 mm.
Breadth of one fore wing, ♀ 29 mm.
Length of one hind wing, ♀ 38 mm.
Breadth of one hind wing, ♀ 30 mm.

Geographical distribution.—Quillota, 20 miles northeast from Valparaiso, Chile (Bartlett-Calvert).

POLYTHYSANA RUBRESCENS (Blanchard).

Plate C, fig. 3.

Attacus rubrescens BLANCHARD, in Gay; Historia fisica y politica de Chile. Zoologia, VII, p. 60, 1852, Lep., pl. 4, fig. 3, ♂.
Polythysana rubrescens WALKER, Cat. Lep. Het. Br. Mus., VI, p. 1315.
Polythysana rubrescens KIRBY, Syn. Cat. Lep. Het., I, p. 785, 1892.

Imago.—1 ♂. Body light chestnut brown. Fore wings tawny ochreous with fawn or chestnut shades. Basal line dark fawn brown, touching the discal ocellus and regularly (not angularly) curved outward before reaching vein VI. On the hinder half of the base of the wing within is a dull chestnut patch extending from base and nearly touching the basal band.

Ocellus not round, but shorter than broad, suboval, tawny, encircled by a dark brown (not black) broad ring, a little more dusky within, i. e., the portion inclosing the narrow linear curved white line. Submarginal line also chestnut brown, the two scallops on vein IV_1 not so deep as in *P. andromeda*, and the sinus in front opposite the discal spot short and deep. An apical roseate spot edged within with white.

Hind wings chestnut or fawn-brown at base; the middle of the wing tawny ochreous from the inner edge to the costa, with no roseate tints within the extradiscal line, which is heavy, black, diffuse and not roseate toward the costa as it is in *P. andromeda*. Discal ocellus a heavy black ring centered with deep roseate ochreous; and with a white median linear crescent. Beyond the extradiscal line the brown margin of the wing is light brick red or roseate, but the fringe is fawn color.

Under side of the wing, yellow ochreous; the ocelli much reduced, those of the fore wings a third smaller than above, pale brick-red encircled with black and a white line. On the hind wings the black ring is obsolete, and there is a small pink-red spot with a white line. Basal line of fore wing wanting, but the extradiscal line is present, and much more distinct than above.

Expanse of the fore wings, ♂ 78 mm.
Length of fore wing, 45 mm.
Breadth of fore wing, 25 mm.
Length of hind wing, 33 mm.
Breadth of hind wing, 26 mm.
Ocellus of fore wings 5½ by 7 mm., of hind wings 7 by 7 mm.

This species is recognized by the pink red being confined to the outer edge of the hind wings beyond the extradiscal line, and by the inside of the discal spot being olive fawn, not blackish.

Geographical distribution.—Chile (Museum d'Hist. Nat. Paris), Coquimbo, Valdivia (Walker in Br. Mus.).

POLYTHYSANA ANDROMEDA (Philippi).

Attacus andromeda PHILIPPI, Linn. Ent., XIV, p. 280, 1860.
Polythysana andromeda WATERHOUSE, Aid to Identification of Insects, I, p. 119, fig. 1, 1882.
Polythysana andromeda KIRBY, Syn. Cat. Lep. Het., I, p. 785, 1892.

Imago.—Two ♂, one ♀. The male is very near *P. rubrescens*, but a little smaller and chiefly differing in the hind wings being deep pink red from the costa to the hinder edge of the discal ocellus. Compared with *P. rubrescens* the basal broad blackish line makes a sharp angle between the costa and ocellus, and the curve near the inner edge of the wing is nearly angular instead of rounded. An apical roseate spot. The ocellus is larger than in *P. rubrescens*, round, and is olive-green encircled by black, the center almost black and the white curved line is less regular in shape. The extradiscal line has a shorter deeper sinus opposite the ocellus, and the sinus on vein VI is deeper than in *P. rubrescens*.

Hind wings of a beautiful roseate pink red on the costal half of the wing, the rosy tint surrounding the large discal ocellus; behind and within the extradiscal line the wing is very hairy and shaggy, deep snuff ochreous, as is also the outer margin of the wing beyond the extradiscal line.

Under side of the wings red center and a broad almost oval white central spot. On the hind wings the ocellus is reduced just as in *P. rubrescens*.

The ♀ is very different, there is no ochreous or pink hue, but the ground color is olive green, paler along the edge beyond the extradiscal line of both wings, but the lines and ocelli are the same. Ocellus of the fore wings large, round, black, only the center white, with a few pink scales. The abdomen is banded above and with scattered long light hairs; and beneath olive ochreous, with a lateral row of dark irregular roundish spots.

Expanse of fore wings, ♂ 70 mm.; ♀ 95 mm.
Length of fore wing, ♂ 39 mm.; ♀ 52 mm.
Breadth of fore wing, ♂ 21 mm.; ♀ 30 mm.
Length of hind wing, ♂ 30 mm.; ♀ 42 mm.
Breadth of hind wing, ♂ 22 mm.; ♀ 31 mm.
Ocellus of fore wing, ♂ 7½ by 7½ mm.; ♀ 9 by 8½ mm.
Ocellus of hind wing, ♂ 8½ by 8½ mm.; ♀ 10 by 10 mm.

Geographical distribution.—Chile (Franck).

Subfamily 3. Urotinæ Packard.

Head of moderate size; front moderately wide, and not narrowing toward the oral region; its vestiture either not very long and shaggy (*Urota*), or quite shaggy in *Eudelia* and the hairs spreading so as to partially conceal the eyes. Antennæ of the male plumose, *but a single pair of pectinations to a joint*, in ♀ but little less pectinated than in ♂. Palpi short, porrect or depressed, feeble. Maxillæ not visible.

Fore wings falcate, the apex squarish, not acute or much produced; outer edge with a shallow (*Urota*) or deep excavation (*Eudelia*), inner angle well rounded. Hind wings in ♂ with a well marked tail about one-fifth to one-fourth as long as the wing itself; in ♀ there is instead a distinct angle; apex of the wing well rounded. The abdomen in ♂ does not extend to the inner angle of the wing.

Venation: There are 11 veins in the fore wings; discal cell rather small, the outer side formed by the discal veins taken together, is short and straight not oblique; vein III_2 either partly detached (*Urota*) or wholly so (*Eudelia*), forming a true independent vein. In *Urota* the venation of the fore wings is much as in *Aglia tau*, though that of the hind wings is quite different; in these the two discal cells taken together are oblique (*Urota*) or extremely so (*Eudelia*), vein III_3 alone entering and supporting the ♂ tail. There are eight veins in the hind wings.

Legs moderately long; the ♂ fore tibial epiphysis in *Eudelia* very large, nearly as long as the tibia itself.

The two genera forming the types of this group (and *Cercophana* most probably) can not apparently be placed in the Agliinæ, though very near *Aglia*. *Cercophana* is tailed, and seems to be near *Eudelia*, and the larva is apparently similar to that of *Aglia;* on the other hand they can not be placed in the Bunæinæ; at present it seems best to provisionally assign the three genera to an independent group, until the larva of *Eudelia* has been discovered.

Also the larval characters, the two separate dorso-median tubercles of *Urota*, forbid the assignment of that genus to the Agliinæ or Bunæinæ; on the other hand there is a resemblance between the full fed larva of *Aglia* and *Cercophana*.

Larva.—Body cylindrical, generalized in its outlines, head large, round, unarmed; tubercles very minute, reduced, flattened, giving rise to flattened setæ. On the eighth abdominal segment *not a double (fused) median tubercle*, as in Bunæidæ and most Agliinæ, *but two separate minute ones*. The discovery of the first larval stage of these genera will throw much light on the phylogeny of the group; at present it appears as though it may have sprung from some primitive spined form, resembling the freshly hatched larva of *Arsenura* and *Aglia*.

[A separate memorandum notes:] Larva with multisetose tubercles. [The same (provisional) memorandum refers *Tagoropsis*, *Urota*, *Usta*, and *Ludia* to Urotinæ, but notes that *Ludia* and

Usta spin cocoons. Mr. J. H. Watson writes that *Ludia* and *Aglia* spin cocoons. *Ludia*, in the arrangement now given, is excluded from the Ceratocampidae.]

Geographical distribution.—The range of this group embraces Chile and southeast Africa; two genera being restricted to south temperate America, the Chilian subregion (Wallace) or province of the Neogaeic realm of von Ihering, and the third to the Aethiopian realm. Thus far no forms are known from the eastern side of South America or the western coast of Africa.

UROTA Westwood.

Urota Westwood, Proc. Zool. Soc. London, p. 60, 1849.
Urota Walker, Cat. Lep. Het. Br. Mus., VI, p. 1330, 1855.

Imago.—♂ and ♀. Head in front moderately wide, not narrowing below, toward the labral region; the hairs are long, uneven, and project straight out, not radiating so as to partially conceal the eyes, which are moderately large and round. Antennæ of ♂ subplumose, well pectinated to the ends, and the joints numerous, shorter than wide on the basal half and bearing but a single pair of long slender fine branches, which are well ciliated, but the extreme tip is filiform; those of the ♀ but little less pectinated than in the ♂, the pectinations being but slightly shorter than in the ♂.

Palpi short, hairy, directed downward and not easily distinguished from the hairs of the front of the head; thorax moderately stout, shaggy. Maxillæ not visible.

Fore wings falcate; outer edge slightly concave. The hind wings are tailed in ♂, the tail short and broad; in ♀ the wing is wider, with a wide projection corresponding to the tail of the male.

Venation: Vein II_1 [III_1, in revised nomenclature] arises in the outer third of the discal cell close to the stalk giving origin to veins II_3 and II_4; no vein II_2 present; origin of vein III_2 a little detached from vein II and III, situated nearly one-third across end of discal cell; the discal cell rather large and long compared with that of *Eudelia*, the hinder discal vein not directed outwards. Hind wings with the two discal veins taken together not so long and oblique as in *Eudelia*, otherwise the venation is very similar, though as the ♂ tail is shorter the veins that pass into it are also shorter.

Markings: Body and wings uniform fawn brown; fore wings with a basal and extradiscal line and a small opaque white oval (♂) or round (♀) discal spot on both wings. Abdomen in the ♂ rather short, not reaching to the inner angle of hind wings; in ♀ longer, extending to this angle. There is a quite close relationship between this genus and the Chilian *Eudelia*.

Larva.—Body cylindrical; head large, round, smooth. The body segments are not convex, the caterpillar being generalized in its outlines. The tubercles are in six rows on each segment behind the head as usual in Saturniidae, minute, flattened, not easily seen in blown specimens, and give rise to two to five short flattened setæ, each one arising from a minute wart situated on the tubercle. On the eighth abdominal segment not a double median tubercle, but two separate minute ones. Suranal plate rounded, convex, with three setiferous but minute tubercles on each side. Anal legs of moderate size.

In the much reduced tubercles we have a highly specialized feature. In the pair of separate dorsal tubercles on the eighth abdominal segment we have a feature not characteristic of the Sphingicampidæ, but rather of the subfamily Saturniinæ. The bands of highly colored granulations is a not uncommon feature in the group, as we see it in the larva of *Nudaurelia dione* and *Gynanisa iris*.

UROTA SINOPE (Westwood).

Plate XXXI, fig. 12; CX, fig. k.

Urota sinope Westwood, Proc. Zool. Soc. London, 1849, p. 60.
Urota sinope Herrich-Schaeffer, Samml. aussereur. Schmett., p. 60, fig. 94, 1854.
Urota sinope Walker, Cat. Lep. Het. Br. Mus., VI, p. 1331, 1855.
Urota sinope, Kirby, Syn. Cat. Lep. Het., I, p. 764, 1892.
Urota sinope, Maassen and Weymer, Beitrage Schmett., III, fig. 55, 1873.

Imago.—One ♂ and one ♀. Body and wings light fawn-brown (ochreous brown). Antennæ slightly paler. Fore wings narrower in ♂ than ♀, where they are rather wide and more falcate

than ♀; outer edge slightly concave. Hind wings tailed in ♂, the tail short and broad, two-thirds as long as the antennæ; in ♀ the wing is wider, with a wide projection instead of a tail-like one.

Fore wings with a broad straight basal band composed of two white lines with a darker brown line between. Extradiscal line similar, oblique, nearly parallel with the outer edge of the wing, expanding where ending on the costa on the outer fourth of its length. The discal spot is situated rather nearer the extradiscal than the basal line, and is a small opake white spot, larger in the ♀ than ♂, the two lines also being wider and more diffuse.

Hind wings with a narrow white indistinct discal spot, and beyond it is a curved extradiscal whitish band widening on the costal and inner edge of the wing.

Under side of the wings nearly as above, but the lines all less distinct, as also the discal spots. A broad diffuse basal dusky line on the hind wings. All the lines are more distinct in ♀ than ♂.

Expanse of the fore wings, ♂ 70 mm.; ♀ 80 mm.
Length of fore wing, ♂ 34 mm.; ♀ 45 mm.
Breadth of fore wing, ♂ 19 mm.; ♀ 25 mm.
Length of hind wings without the tail, ♂ 25 mm.; with the tail, 31 mm.; breadth, 20 mm.
Length of hind wings without the tail, ♀ 35 mm.; breadth 27 mm.

Geographical distribution.—Port Natal (Donckier; British Mus.).

Larva.—Length, 45 mm. Head moderately large, nearly two-thirds as wide as prothoracic segment, the black surface as usual with groups of from two to six fine granulations. Body cylindrical but the segments convex and rising dorsally into two decided fleshy humps, one on each side of the median line, and with corresponding lateral humps on which are situated the low tubercles. Prothoracic plate thickened on the front edge, and on each side of the median line is a group of seven to eight setiferous minute warts, the group being a vestigial setiferus tubercle; also a more rounded area of warts corresponding to a vestigial supraspiracular tubercle, and also low down, a group of warts corresponding to the infraspiracular tubercle.

On the middle of the second thoracic segment is a double-headed hump with no valley or depression between the two heads; each head crowned by a low vestigial tubercle bearing four setæ. On the third thoracic segment the hump is slightly higher, but with a little valley between the tubercle, each bearing five setæ.

On abdominal segments one to eight the humps are separate, a valley between them, and the setiferous flattened low tubercles, all wider apart. The humps on the eighth segment are no higher and larger, *but the two separate vestigial low flattened tubercles are quite near together, though entirely separate;* each bearing four or five setæ. On the ninth abdominal segment the humps are separated by a wide valley and the tubercles (each with five setæ) are nearly three times as wide apart as on the eighth segment.

Suranal plate wide, triangular, slightly mucronate at the end; on the edge about a dozen small setiferous tubercles on each side; two minute setiferous tubercles, one on each side of the middle of the plate, and other smaller scattered one; the surface is not very rough, rather smooth. The setæ are moderately stiff, rather short, and they are all white.

Anal legs with fine setiferous tubercles around the outer, front, and hinder edges.

Body pale straw-yellow, with transverse velvety brown-black bands extending from the lateral line around over the back, the broad band extending from the hinder edge of one segment to the front edge of the one behind; there are 11 such black bands contrasting with the bright yellow ground color, the first and last of the series narrower and shorter than the others. Farther down on the side before the pleural ridge is a row of 12 irregular conspicuous black spots, the first one and last two much smaller than the others of the series. Spiracles yellow, not easily distinguishable from the yellow surface of the segment on which they are situated.

Thoracic legs blackish; midabdominal legs yellow.

This is a very conspicuously marked larva. It has retained the vestiges of humps and tubercles and the setæ are well developed. It appears to be a normal Sphingicampid some-

what approaching *Lobobunea* in its larval characters, though greatly more spinose; *but it differs very much in the two separate unfused dorsal tubercles on the eighth abdominal segment.* For this and the imaginal characters it may well be regarded as the type *of a distinct subfamily, a somewhat degenerate and highly modified branch given off from the Bunaeinæ, unless we should decide the group to be of family rank.*

This may tend to solve the problem of the position of *Heniocha* (and *Usta?*) which though with two separate tubercles on the eighth abdominal segment are apparently in other respects larval and imaginal (venation), more nearly allied to the Bunaeinæ than to any other group.

Should we regard the Bunaeinæ as a family then *Heniocha* might be regarded as the type of a primitive subfamily of it, and the Urotinæ as an allied side family.

CERCOPHANA Felder.[1]

Cercophana Felder, Verhandlung Wien. Zool. Bot. Ges., XII, p. 496, 1862.
Eudelia Philippi, Stettin Ent. Zeit., XXV, p. 91, 1864.
Lonomia Walker (in part), Cat. Lep. Het. Brit. Mus., VII, p. 1765, 1856.
[True *Lonomia* is a quite different genus.]
Eudelia Maassen and Werner, Beiträge Schmett., IV, V, 1881, 1885.
Eudelia Kirby, Syn. Cat. Lep. Het., I, p. 764, 1892.
Cercophana Rothschild, Novitates Zool., II, p. 46, 1895.

Imago.— ♂. Head and eyes much as in *Urota,* but the hairs of the front or face are very long and spread out sideways so as to partially conceal the eyes, and prevent one from seeing the exact shape of the front. Antennæ of male more broadly pectinated than in *Urota,* with about 40 joints, the pectinations extending to the tip; the joints shorter than long on the basal half, and the longest ones towards the tip are but little longer than thick, those of the base or near the base being half as long as broad. But a single pair of pectinations to a joint, and they are very long and slender, giving a subplumose appearance to the antennæ. Palpi unusually long, a little longer than in *Urota,* directed downward, not easily detected as the hairs clothing them are long, uneven, and somewhat blended with those of the front. Third joint long, depressed. The maxillæ must be very short, vestigial, as they are not visible. Thorax moderately stout, shaggy, much as in *Urota.* Fore tibial epiphysis a large flattened sack-like appendage, as long as the tibia itself.

Fore wings decidedly falcate, more so than in *Urota;* costa straight on the basal three-fourths, but towards the apex much arched or curved, much more so than in *Urota;* outer edge more deeply excavated behind the apex, and the inner angle more rounded than in *Urota.*

Hind wings with the costal edge a little more convex than in *Urota,* the apex more rounded and full; the wing is produced behind into a long broad tail, which is one-third as long as the whole wing, and at base nearly half as wide as the wing itself; compared with the tail of *Urota* it is more than twice as long and wide, and the inner angle of the wing is more decided, the tail being bent outward at a decided angle.

Venation: Vein II_2 [III_2 in revised nomenclature] wanting as in *Urota,* vein II_1 arising remotely from the anterior discal vein, near the middle of the discal cell; otherwise the venation is much as in *Urota,* though the two discal veins taken together form a straight line, not a slightly curved one as in *Urota.* In the hind wings the discal cell is much shorter than in ♂ *Urota,* and the discal veins are together much longer and thicker, as well as more oblique than in *Urota;* the tail is supported by vein III_3 and IV_1; vein III_2 (independent) is short and situated or originating nearer the middle of the extradiscal space or cell.

Fore legs rather stout and hairy, the tibial odoriferous sack very large, swollen at the end and nearly as long as the tibia itself. All the legs larger than in *Urota,* especially the anterior pair.

Markings: Ground color yellowish; the tails more reddish brown. A large round distinct opake white discal spot on the fore wing, reproduced beneath, though less distinct than above. No traces of a discal spot on the hind wings, either above or beneath. Fore wings crossed by

[1] [Sonthonnax (as I am informed by Mr. J. H. Watson) has discussed *Eudelia* and *Cercophana.* True *Eudelia* (type *E. aristoteliæ* Phil.) has no incipient tails in the female, whereas *Cercophana* (type *C. frauenfeldi*) has the female hind wings with incipient tails.]

three lines; a curved basal one, a straight extradiscal one, and just beyond a distinct deeply scalloped reddish brown line. On the hind wings are two closely parallel extradiscal lines.

The distinguishing marks of this genus are the rather long broad tails of the hind wings; the falcate fore wings; the plumose antennæ, and the unusually long palpi.

Larva.—When full-fed the body is entirely unarmed.

Geographical distribution.—Neogaeic. All the species are reported as inhabiting Chile only.

[CERCOPHANA VENUSTA (Walker).]

Plate XXXI, figs. 14, 15; CXI, fig. j (*frauenfeldi*).

EUDELIA RUFESCENS Philippi.

Eudelia rufescens Philippi, Stettin Ent. Zeit., XXV, p. 91, 1864.
Eudelia rufescens Maassen and Weymer, Beiträge Schmett., IV, figs. 75, 76, 1881.
Eudelia rufescens Preuss, Abbild. Nachtschmett., p. 8, Pl. 11, fig. 1, 1881.
Eudelia rufescens Kirby, Syn. Cat. Lep. Het., I, p. 765, 1892.
Cercophana venusta Rothschild, Nov. Zool., II, p. 47, 1895.
Cercophana rufescens Rothschild, Nov. Zool., II, p. 47, 1895.
Cercophana vulpes Rothschild, Nov. Zool., II, p. 47, 1895.
Cercophana daphnea Rothschild, Nov. Zool., II, p. 47, 1895.
Cercophana frauenfeldi Rothschild, Nov. Zool., II, p. 47, 1895.

Imago.—One ♂. Body and wings fawn color or yellowish sienna brown; with reddish ochreous markings; antennæ of nearly the same color. Fore wings uniformly yellow fawn or sienna brown; a basal curved diffuse line; extradiscal line not curved or scalloped but oblique, and beyond is a scalloped line of the same hue, situated about half way between the extradiscal line and the outer edge of the wing. Discal spot large, round, white, opaque, entirely covered with white scales, and narrowly encircled with dark brown. Fringe reddish brown, yellow on the inner angle.

Hind wings yellow ochre, becoming reddish brown towards the base of the tail, which is also reddish brown. Fore wings beneath as above, but a little paler, becoming reddish around the discal spot which is a little smaller than above, and with a brown haze or cloud around it, not forming a definite brown ring as above. The under side of the hind wings more yellow than above, and yellow on the tails.

Expanse of the fore wings, ♂, 66 mm.
Length of a fore wing, ♂, 33 mm.
Breadth of a fore wing, ♂, 18 mm.
Length of hind wing, including tail, 38 mm.; tail alone, 15 mm. long; breadth at base, 9 mm.
Breadth of hind wing, 18 mm.

Walker in his diagnosis of *Lonomia* does not refer to the tails of the hind wings.

Geographical distribution.—Thus far not known to range beyond the coast of Chile.

Rothschild considers that *rufescens* (Phil.), *vulpes* (Butler), *daphnea* (Maass. and Wern.), and *frauenfeldi* (Felder) are aberrant forms of *C. venusta* Walker.

Larva.—Our knowledge of the larva of this genus is derived from a colored drawing in the British Museum, of which fig. 14, Pl. XXXI, is a copy, which I was kindly allowed by Sir George Hampson to have made. It is labelled "*C. frauenfeldi.*"

On comparing this with an alcoholic example of *Aglia tau*, and the excellent figure by Prof. Poulton, which evidently well represents its characteristic attitude when at rest, the resemblance between the larvæ of the two genera in their final stage is striking.

In *Cercophana* the body is smooth and unarmed; the segments apparently not convex, and smooth; the head is small and the two anterior thoracic segments small, while apparently the tergum of the metathoracic segment (unless it be the first abdominal) is prolonged into a long median process, which overhangs the retracted head and two anterior thoracic segments. Also the suranal plate is greatly prolonged into a sharp conspicuous process. Along the sides is a row of six long black setæ which extend downward and backward. The body is brownish

or bronze along the back, green on the side and beneath, while a conspicuous yellow lateral line extends from the tip of the anterior to that of the posterior horn or projection. It has no lateral eye-like red spot on the side of the first abdominal segment.

The larva, however, so far as we can judge from a figure alone, is evidently closely allied to *Aglia tau*, as is the moth.

It will be a matter of the greatest interest to have the larval history of this genus worked out; we should expect that its freshly hatched larva is armed with spines as in *Aglia*, which are discarded at the last molt. It is a matter of the utmost importance that the entomologists of Chile should secure the eggs and rear the larva, securing the larvæ in all stages and the pupa, and to ascertain whether the pupa is subterranean or protected in a cocoon.

CERCOPHANA MIRABILIS Rothschild.

Cercophana mirabilis ROTHSCHILD, Nov. Zool., II, p. 46, Pl. X, figs. 6, 7, 1895.

Imago.—"The most obvious differences which separate this species at a glance from any of the varieties of *E. venusta* (Walk.) are its small size (barely half that of *venusta*), strongly dentated margins to all wings, and absolutely tailless hind wings in both sexes.

"Male: Fore wings deep rufous chocolate, a large round white spot situated at apex of cell, beyond which is a transverse bar of darker chocolate. Hind wings orange yellow, with the outer third reddish chocolate, and a central narrow transverse band of the same color.

"Underside similar, but all the colors and markings more mixed and indistinct.

"Female: Fore wings reddish gray, with a dull yellow round spot at the apex of cell, between which and the base of the wing are two indistinct red transverse lines, and beyond the cell again are two broader and more distinct ones.

"Hind wings reddish gray, more brown toward the margins, and crossed by two very indistinct transverse lines. Under side identical.

"Expanse, ♂ 1½ inches = 38 mm.; ♀ 2 inches = 51 mm.

"Hab. Chile (in coll. Staudinger)." (Rothschild.)

This is probably the type of quite a distinct genus; the fore wings are not falcate, and the hind wings besides being tailless are quite different in shape.

[It is said to look like an *Orgyia*.]

[NEOCERCOPHANA Izquierdo, 1896.

Plate CXI, figs. k. l.

The type of this genus is *N. philippii* Izquierdo, 1896, from Chile. Izquierdo describes the metamorphoses.]

Subfamily BUNÆINÆ Packard.

[*Bunaeinæ* PACKARD, Psyche, February, 1902, p. 306.]

Head: When denuded the front is somewhat shield-shaped or subtriangular, moderately wide, a little wider than one eye seen from in front, narrowing a little toward the oral region. Antennæ of ♂ bipectinate, either with rather short pectinations on basal three-fourths, leaving the tip filiform (*Imbrasia*) or pectinated to the tip and more or less plumose, the pectinations being unusually long and slender; those of ♀ subsimple (or simple).

Palpi three-jointed.

Wings large and broad; fore wings with 11 veins, broad, large, as a rule about one-half as wide as long; the costal edge more or less curved; the apex either subacute (*Lobobunæa*) or acute (*Bunaea*); the outer edge entire (*Usta*) or excavated, and in certain genera (*Lobobunæa* and *Bunaea*) scalloped.

Hind wings either normal, the apex squarish, the outer edge slightly convex (*Usta*), or the apex is rounded, and there is a decided angle in the outer edge (*Cirina*) or a short tail (*Imbrasia*), but in the other genera the outer edge is convex, full, though *Gynanisa ethra* has a short tail.

Vein III_2 is never detached so as to form an independent vein; there is only a tendency to it in *Nudaurelia,* the tendency being most marked in [*Acanthocampa*] *belina.* The venation is very uniform. The number of veins is invariably eight.

Fore wings: The discal cell rather narrow; the two discal veins form a line which is situated either in the middle (*Usta, Salassa*) or a little beyond the middle of the wing (*Bunaea*), and the line varies in being curved or bent outward or inward. It is situated farthest outward in *Bunaea.*

Vein II_1 [III_1 in revised nomenclature] arises before the origin of the stalk of II_3 and II_4, in the outer third of the discal cell (in *Usta, Cirina, Imbrasia, Antherina, Nudaurelia, Gynanisa, Lobobunæa,* and *Salassa*). The same vein in *Thyella,* [*Acanthocampa*] *belina* and *Bunaea* arises at the end of the discal cell in front of the anterior discal vein.

Hind wings: Vein III_2 semiindependent in *Imbrasia* and *Antherina;* in [*Acanthocampa*] *belina* it becomes almost entirely independent, more so than in any other genus of the group.

[The original definition of Bunaeinæ, in the place cited, is as follows:

"Antennæ bipectinate, tip filiform, or pectinated to tip. Vein III_2 is never detached so as to form an independent vein. Wings usually very large, and in the more specialized genera closely approaching the Saturnian *Antheræa* (a case of parallelism or convergence), but the larvæ are entirely different, not spinning a dense cocoon and being armed with stout long spines (in certain genera spinulated), instead of soft tubercles crowned with several small short spines. Pupa like that of *Eacles* in type, ending in a large spine-like cremaster, and subterranean.

There are three groups in this subfamily. The first and most generalized (*Imbrasiæ*) is represented by the three genera of which *Usta* is the most generalized; while *Cirina,* and especially *Imbrasia,* with its tailed hind wings, is the most specialized. [Here also *Gonimbrasia.*]

The second group is a more natural one, the *Bunaeæ,* all the three genera being closely allied, and their larvæ known. They are *Thyella,* [*Acanthocampa*] *belina* and *Bunaea.*

The third is perhaps more modern, more specialized, some of the forms, as *Nudaurelia,* closely mimicking *Antheraea* of the Saturniidæ, in the shape of the antennæ, wings, and the presence of large ocelli similar to those of the silk-spinning family, though the larvæ are very different as well as the transformations.

USTA Wallengren.

[*Usta* WALLENGREN, Wien. Ent. Mon., VII (1863), p. 142.]
[Type *Usta wallengrenii* (Felder).]

Imago.— ♂. Head moderately wide in front; fairly prominent, scales long, erect, adding to the size of the head and prominence of the front. Antennæ of the male unipectinate, well pectinated, nearly to the tip, the last five joints without pectinations; the joints numerous (50), very short, only one pair of (basal) pectinations present with no vestiges of distal pairs which are naked, scarcely ciliated. Palpi very stout, thick, and short, only reaching to the front; consisting of but a single joint, small and short. Thorax moderately stout. No tongue visible even after the removal of a palpus.

Fore wings rather narrow and small, of nearly the same proportions as in *Saturnia;* costa straight at base, much curved toward the apex, which is much rounded, unusually so; outer edge not so long as the inner edge, straight, not incurved. Hind wings moderately wide; apex well rounded, outer edge not very convex; abdomen not quite reaching the inner angle of the hind wings.

Venation: Vein II_1 arises not far beyond the middle of the discal cell, and close to the origin of the stalk giving rise to II_3 and II_4. Vein II_2 present. Vein III_2, not forming an independent and giving rise to the anterior discal vein; the two discal veins directed inward, forming a common line bent inward. Hind wings with the discal cell very long, the discal veins being situated far beyond the middle of the wing, the two together being sharply bent inward, the distance between the origin of veins II and III being the same as between the origin of the latter and of the posterior discal vein.

Markings: Ground color white, spotted, or marbled with red; a large round discal ocellus of nearly the same size in each wing. Hind wings nearly white. Fore legs with two large stout tibial spines at the end of the fore tibia, the outer spine larger than usual; the tibia is unusually short, compared with the femur. The odoriferous appendage is about three-fourths as long as the tibia itself, narrow, subacute, and hairy on the inside.

This genus is *Saturnia*-like in shape and size of wings, as well as the discal ocelli, but the venation shows plainly enough family distinctions; it is remarkable for the very short bushy palpi, which are only one-jointed, and for the antennæ which are not *bipectinate*, the discal pair of pectinations entirely wanting, there being no vestiges of them.

Geographical distribution.—British East Africa, Tzavo.

USTA ANGULATA Rothschild.

Usta angulata ROTHSCHILD, Novitates Zool., II, p. 50, Pl. X, fig. 5, 1895.

Imago.—One ♂. Body and wings a ground color of white scales, spotted and marbled with scattered bright roseate pink red scales. Head in front and fore legs tawny; breast roseate. There are on the body two roseate lines, one on each side of the thorax, also a transverse roseate line across the basal abdominal segment; the abdomen being white marbled with pink red. The scales are very fine and close.

Fore wings white, with scattered pink scales. An extradiscal very deeply and sharply zigzag line. Discal ocellus a black ring inclosing a bright ochre-yellow area, with a reddish center; the same on the hind wings, which are crossed by a wavy extradiscal line. The markings are the same beneath.

Expanse of fore wings, ♀ 92 mm.
Length of fore wing, ♀ 45 mm.
Breadth of fore wing, ♀ 23 mm.
Length of hind wing, ♀ 32 mm.
Breadth of hind wing, ♀ 24 mm.

Described from a much rubbed imperfect specimen, received from the British Museum, with the examples in which my specimen was compared and named.

Geographical distribution.—"British West Africa (Gregory coll.), Tzavo (from British Museum); Mombasa, East Africa, lat. 4° 5′ (Rothschild)."

Rothschild states that this species differs from *U. wallengreni:* First, "the transverse angulated submarginal band in *U. wallengreni* (Feld.), is convex, follows the outline of the wings, and its angulations are the same size throughout, while in *angulata* the band is quite zigzag and the lower angulations are quite three times the size of the upper; secondly, the ocelli are much larger, and the fulvous center is reduced to a narrow ring." "Expanse 3½ inches = 88 mm."

USTA WALLENGRENI (Felder).

Saturnia wallengreni FELDER, Wien. Ent. Mon., III, p. 323, Taf. VI, fig. 2, 1859.
Usta wallengreni WALLENGREN, Wien. Ent. Mon., VII, p. 142, 1863.
Saturnia terpsichorina WESTWOOD, Oates, Matabele Land, p. 357, 1881.
Saturnia wallengreni BUTLER, Trans. Ent. Soc. London, 1889, p. 391.
Heniocha terpsichorina KIRBY, Syn. Cat. Lep. Het., I, p. 771, 1892.
Usta wallengreni ROTHSCHILD, Nov. Zool., II, p. 50, 1895.

[*Geographical distribution,* Caffraria].—Fifty miles inland [from] Mombasa (Tring Museum).

USTA (?) TERPSICHORE Maassen.

Plate XXXI, fig. 13.

Saturnia (?) *terpsichore* MAASSEN and WEYMER, Beitrage Schmett., fig., ♂, 113, ♀, 114, 1885.
Heniocha terpsichore KIRBY, Syn. Cat. Lep. Het., I, p. 771, 1892.
Heniocha terpsichore ROTHSCHILD, Nov. Zool., II, p. 49, 1895.

Imago.—One ♀. Head a little darker, more fulvous than the thorax, which is of a soft pale leonine hue or fawn color, with no pink scales. Antennæ well pectinated. Palpi deep red, as also the fore legs, except the last tarsal joint which is fawn color.

Fore wings subacute at tip, apex not rounded; the ground color whitish ash, reddish on the costal edge, especially beneath; the basal line curved, bent outward on veins III and V. Extradiscal line sinuous, somewhat parallel with the outer edge and quite regularly scalloped, the seventh scallop or point acute; all nearly the same size. Beyond are three or four parallel faint wavy ashen or fawn colored lines on a whitish field; edge of the wing light fawn. Discal ocellus round, slightly oval, moderately large (7 by 5 mm.) consisting of a black ring inclosing a pale fawn area, the center of which is darker fawn, with white scales, densest on the inner side.

Hind wings cream-white; base of wing clear white; a faint extradiscal line nearly touching the ocellus; it is sinuous and fades out toward the costa. Edge of the wing sparingly dusted with dark scales. Ocellus about a third smaller than that on the fore wing (6 by 5 mm.), not quite round, the dull ochreous ring is broader than in the ocellus of fore wing, and incloses a brown center, with white scales on the inner side (no red scales as figured by Maassen).

Beneath as above, but fewer white scales in the ocelli.

Abdomen; with reddish scales along the sides of the abdomen, forming a series of lateral red spots.

Expanse of fore wing, ♀ 100 mm.
Length of a fore wing, ♀ 50 mm.
Breadth of a fore wing, ♀ 27 mm.
Length of a hind wing, ♀ 35 mm.
Breadth of a hind wing, ♀ 28 mm.

The specimen in the Schaus collection of the American Museum of Natural History agrees well with Maassen and Weymer's figure, but there are no red scales in the ocelli.

Geographical distribution.—Delagoa Bay (Schaus, Maassen).

CIRINA Walker.

Saturnia Westwood, Proc. Zool. Soc. London, 1849, p. 52.
Bunaea Walker, Cat. Lep. Het. Br. Mus., VI, p. 1232, 1855.
Cirina Walker, Cat. Lep. Het. Br. Mus., VI, p. 1382, 1855.
Sculna Wallengren, OEfv. vet. Akad. Forh., XV, p. 139, 1858.
Cirina Kirby, Syn. Cat. Lep. Het., I, p. 763, 1892.

Imago.— ♂. Head rather narrow in front, which is triangular, narrowing more in front as in *Imbrasia*, but a little more full and hairy; antennæ with about 25 joints, broadly pectinated, scarcely plumose, much as in *Imbrasia*, with two pairs of branches to a joint; the pectinations long and slender, much ciliated to near the tip, which is filiform, in the last five joints in ♀ subsimple; pectinations of both pairs triangular, tooth like, those of the distal pair about one-third as large as those of the basal pair. Eyes moderate in size. Palpi small, weak, depressed, almost invisible, not reaching the front. Body woolly, the wings thin-scaled.

Fore wings moderately wide, rather small, subfalcate; costa somewhat curved toward the apex; outer edge very slightly incurved behind the apex; outer and inner edge of about the same length; apex moderately pointed. Hind wings in ♀ with a pronounced angle (in one ♀ the wing is well rounded), the outer edge in front of the angle slightly excavated, behind the angle straight.

Venation: Similar to that of *Imbrasia*, but the origin of vein II [III, in revised nomenclature] and of the stalk of II_3 and II_4 are much farther apart; vein II_2 is absent; in the hind wings the discal cell is wider than *Imbrasia*, vein III_2 originates nearer III_1, and the two discal veins taken together form a straight line, not directed outward as in *Imbrasia;* vein III_3 ends in the distinct angle.

Markings: A triangular dark ash-brown discal spot, with a minute clear center situated outside of the discal vein. Hind wings with a much larger dark smoky brown ocellus, round, with a nearly clear center surrounded by a white diffuse broad ring.

Geographical distribution.—Ethiopian region; Natal.

This genus is allied to *Imbrasia*, as shown by the venation, the palpi and the antennæ; as well as the distinct angle of the hind wings. In the markings also the two genera closely

approach each other, as in *Cirina* the small triangular discal spot of the fore wings and the round ocellus resemble those of *Imbrasia*, though *Cirina* is less specialized in the shape of its wings and the colors and size of the ocellus of the hinder pair, and shows a slight amount of degeneration in the loss of vein II_2, and suggests that *Imbrasia* is the older form.

CIRINA FORDA (Westwood).

Plate XXXII, fig. 1; XXXV, fig. i; CX, figs. a–e.

Saturnia forda Westwood, Proc. Zool. Soc. London, 1849, p. 52, No. 18.
Bunaea forda Walker, Cat. Lep. Het. Br. Mus., V, p. 1232, No. 8, 1855.
Sculna invenusta Wallengren, Wein. ent. Monatschr., IV, p. 168, No. 37, 1860.
Sculna invenustus Wallengren, Vet. Akad. Handl. (2) V, (4), p. 27, 1865.
Cirina cana Felder, Reise d. Novara, Lep., IV, Taf. 88, fig. 3, 1874.
Cirina forda Kirby, Syn. Cat. Lep. Het., I, p. 763, 1892.

Imago.—One ♂ and two ♀. Body and wings of a uniform pale umber or smoke-brown hue. Head in front and tibiæ reddish brown. No basal line on either wing. On the fore wing is a faint dark extradiscal line beginning on the outer third of the inner edge and ending just before reaching the costal edge on its outer fifth, the line being situated halfway between the discal spot and the outer edge of the wing; the line is not sinuous. A much fainter extradiscal line on the hind wings, passing much nearer the ocellus. Underside with the markings as above, but less distinct, and on the hind wings more diffusely whitish around the ocellus.

"The female has the body and wings of a pale reddish buff, with the dusky striga beyond the middle almost obliterated, and the dusky spot in the middle semicircular. On the underside the hind wings have also a small oval dark spot toward the base." (Westwood.)

Expanse of the fore wings, 100 mm.
Length of a fore wing, 45 mm.
Breadth of a fore wing, 24 mm.
Length of hind wing, 37 mm.
Breadth of hind wing, 23 mm.

Rothschild states that *C. cana* Felder is "only a small ♂ much rubbed and faded"; after comparison with Felder's figure we should agree with this opinion.

Larva.—Last stage: Length 53 mm., width of head 6 mm. Head of the usual shape, black, more finely granulated than usual, but the granulations are arranged in groups and lines as usual. Antennæ, lateral region and mandibles chestnut brown. Body cylindrical, with no tubercles or spines, *the two dorsal setiferous warts on the eighth and ninth abdominal segments separate, or paired as in the preceding segments.*

Prothoracic plate smooth, only slightly rugose; the only traces of tubercles are a single setiferous wart, one on each side of the median line near the front edge; and farther toward the side is a group of three or four warts, and another group of four or five warts in front of each spiracle; these give rise to long hair-like setæ, which are usually rubbed off on handling; two long white hairs arise behind the middle of the plate, one on each side of the median line. The dorsal tubercles on the other segments are represented by groups of scattered warts, giving rise to long thickened white hairs, the longest about two-thirds as long as the body is thick.

On the eighth abdominal segment are two setiferous warts in place of a definite tubercle, each wart having two setiferous wartlets and situated quite wide apart; the two dorsal setiferous warts on the ninth segment are also similarly paired, each vestigial tubercle (larger than those on the eighth segment) being about five setiferous warts.

Suranal plate short and broad, well rounded behind, rather smooth, a few (three) long setæ on each side or near each side near the base of the plate, and minute setiferous warts scattered over the surface. Anal legs of moderate size, rounded triangular, with a few fine setæ along the edge.

Surface of the segments very rugose, thrown up into sharp wavy microscopic ridges. The hinder edge of each segment bearing two or three rows of oval pearly fungoid spots, either yellow or white on top. On the side of the body above and around the dark spiracles they are much

more abundant; as a rule they have a central pit, but bear no hairs. There are a few such fungoid warts on the underside of the body. Thoracic legs black, the midabdominal legs brown.

Stage before the last?: Length 30 mm., width of head 4 mm. Exactly as in the last stage, but the fungoid warts are all white. The setiferous warts are scarcely larger or more pronounced than in the last stage, but the paired dorsal ones on the ninth abdominal segment are a little larger than those on the eighth segment and seated on a ridge, and each incipient tubercle bears about four setiferous warts, while those on the eighth segment each bear only two long setæ.

Thus *Cirina* is seen to be a primitive generalized form, as regards the larva, as in *Usta* and *Heniocha*, and we have in this family a group of generalized forms like *Saturnia*.

[An allied form has recently (1911) been described as *Cirina butyrospermi* Vuillet.]

IMBRASIA Hübner.

Imbrasia Hübner, Verzeichniss bek. Schmett., p. 154, 1822.?
Lomelia Duncan, Naturalists' Libr., exot. moths, p. 125, 1841.
Bunaea Walker, Cat. Lep. Het. Br. Mus., V, p. 1233, 1855.
Imbrasia, Maassen and Weymer, Beitrage Schmett., V, 1886.
Imbrasia Kirby, Syn. Cat. Lep. Het., I, p. 753, 1892.
Imbrasia, Sonthonnax, Annales Labr. d'Etudes de le soie, X, p. 46, 1901.

Imago.— ♂ and ♀. Head moderately large; front moderately wide, not triangular, but with the sides parallel. Male antennæ with 25 joints, bipectinate, moderately wide, the last joints with vestigial pectinations, tip subfiliform for a distance nearly as wide as the pectinated portion; joints rather long and slender; distal pectinations as long as the basal ones in the middle, but toward the filiform tip they become shorter, in ♀ filiform, flattened; distal teeth about a quarter as large as the basal ones, naked, not scaled on top, only a few scales present. Palpi short, depressed, stout, not reaching the front; third joint distinct, but depressed and not passing beyond the end of the second joint.

Fore wings falcate, markedly so in ♂, costa straight on the basal two-thirds; toward the apex arched, apex itself obtuse; outer edge quite deeply concave in ♂, less so in ♀.

Hind wings with the apex square, angulated, and outer edge continued into a marked acute angle almost forming a "tail"; the inner angle decided; in ♀ the apex is rounded; the outer edge only slightly bent. The abdomen does not reach the inner angle of the hind wings in either sex; in the ♂ only as far as the extradiscal line. Legs rather long and stout.

Venation: Vein II_2, [III_2 in revised nomenclature] present, well developed, arising near, just within, end of vein II_1; vein II, and stalk of veins II_3 and II_4 arising near each other and just beyond the outer third of the discal cell; veins III_1 and III_2 arising at the same point as origin of discal vein, vein III_2 not detached, and arising at a point toward the middle of the discal cell; discal veins together forming a slightly curved line, directed a little outward. Hind wings and vein III_3 supporting the tail; discal veins forming an oblique line directed outward; origin of vein III_2 detached from that of vein III_1.

Markings: Ground color reddish brown; no ocellus on the fore wings, only a small subtriangular clear spot; on the hind wings a large complete ocellus, which, however, contains only a small clear spot.

Legs rather slender; fore tibiæ slender (when denuded) with no spurs; the odoriferous sack about two-thirds as long as the tibia itself, narrow lanceolate oval, very sharp at the end, with a median ridge along the outside.

The genus may be recognized by the narrow antennæ, filiform in the female, by the short stout palpi, the falcate fore wings, and the prominent angle on the hinder pair, forming short tail. The species are of large size. In venation this genus is near *Gynanisa*, belonging in that section of the family.

Geographical distribution.—West coast of Africa, Cameroons, [Nyassa]. *I. epimethea* Cramer is Huebner's type. [Kirby (Cat. Lep. Het., I, p. 754) considered this to be distinct from the original *I. epimethea* (Drury), and renamed it *crameri*. Rothschild considers *crameri* to be a form of *epimethea* (Drury).]

IMBRASIA EPIMETHEA (Drury).

Plate XLII, fig. 5; CIX, fig. e–g.

Attacus epimethea DRURY, Illust. Exot. Ent., II, Tab. 13, figs. 1, 1773.
Phalaena-Attacus epimethea CRAMER, Papillons Exotiques, II, Taf. 176, A, 1777.
Imbrasia dorcas HÜBNER, Verzeichniss bek. Schmett., p. 154.
Bunaea mopsa WALKER, Cat. Lep. Het. Brit. Mus., p. 1233, No. 11, 1855.
Bunaea dorcas WALKER, Cat. Lep. Het. Brit. Mus., p. 1233, No. 12, 1855.
Bunaea epimethea WALKER, Cat. Lep. Het. Brit. Mus., p. 1234, No. 13, 1855.
Gonimbrasia obscura BUTLER, Annals and Mag. Nat. Hist., (5) II, p. 462, 1878.
Gonimbrasia hebe MAASSEN and WEYMER, Beiträge, V, figs. 84, 85, 1886.
Imbrasia dorcas MAASSEN and WEYMER, Beiträge, V, fig. 112, 1886.
Imbrasia crameri KIRBY, Syn. Cat. Lep. Het., I, p. 754, 1892.
Imbrasia dorcas KIRBY Syn. Cat. Lep. Het., I, p. 753, 1892.
Imbrasia epimethea ROTHSCHILD, Nov. Zool., II, p. 39, 1895.

Imago.—One ♂, one ♀. Body and wings uniformly reddish brown (mink color). Antennæ and legs dark brown, wings of both pair pinkish at base, as is the abdomen. Fore wings with a faint diffuse hoary pink basal line, more distinct in ♀, situated nearer the discal spot than to the base of the wing, interrupted in the middle of the wing, and widening into a large hoary pink spot opposite the discal spot and extendeng to and upon the costa. Extradiscal line oblique, slightly curved, ending on the costa on the outer sixth of its length; hoary pink, lined externally with brown, and in the costa extending inward along the costal edge. Discal spot a single subtriangular clear spot, with rounded angles, larger in ♂ than ♀, where it is very small. Extradiscal line a little curved outside of the ocellus; in ♂ lined externally with dark brown. Ocellus large, oval cylindrical, a large deep yellow-ocher center, circled with black, pink red and externally with pinkish ocher white; in ♀ a slight clear center.

Under side of the wings with no discal spot on the hinder pair, and in the fore wings only a minute clear suboval spot in ♀; the spot is as large as on the upper side; the ♀ wings of both pairs are more hoary than in the ♂.

Expanse of fore wings, ♂ 102 mm.; ♀ 128 mm.
Length of fore wing, ♂ 58 mm.; ♀ 63 mm.
Breadth of fore wing, ♂ 32 mm.; ♀ 33 mm.
Length of hind wing, ♂ 50 mm.; tail, 5 mm.; ♀ 43 mm.
Breadth of hind wing, ♂ 31 mm.; ♀ 33 mm.
Ocellus in hind wings, ♂ 10 by 7½ mm.
Ocellus in hind wings, ♀ 11 by 8½ mm.

Geographical distribution.—Cameroons, Africa (Staudinger and Bang-Haas).

Rothschild has determined that *I. obscura, hebe, dorcas, crameri* and *mopsa* are all synonyms[1] of *I. epimethea*. It is evident that *G. obscura* Butler presents no differences from the *epimethea* of Drury. Rothschild states that he has 18 specimens of *I. epimethea*, and "they show every gradation between the five named aberrations."

[*I. deyrollei* (Thoms.) is however considered a distinct species. Other species and subspecies have been described as *anthina* Karsch (1893), *cleoris* Jordan (1910), *nyassana* Rothschild (1907), and *lucida* Rothschild (1907). C. Oberthür (Etud. Lep. Comp., 1910) gives a good figure of *I. ertli* Rebel, remarking that the larva is very different from that of *Nudaurelia* (i. e., *Acanthocampa*) *belina*. In the same work he figures and fully discusses *deyrollii* Thomson (this is the original spelling), which he refers to *Bunaea*.]

GONIMBRASIA Butler.

Saturnia WESTWOOD, Proc. Zool. Soc. London, 1849, p. 55; 1881, p. 143.
Antheraea WALKER, Proc. Nat. Hist. Soc. Glasgow, I, p. 343, 344, 1869.
Gonimbrasia BUTLER, Ann. and Mag. Nat. Hist., (5) II, p. 462, 1878.
Bunaea DRUCE, Proc. Zool. Soc. London, 1886, p. 409.
Bunaea MAASSEN and WEYMER, Beiträge z. Schmett., 1886.

[1] [Rothschild considered *obscura* the normal female of *epimethea*, and listed the other four names as aberrations.]

Gonimbrasia Kirby, Syn. Cat. Lep. Het., I, p. 753, 1892.
Gonimbrasia Rothschild, Nov. Zool., II, p. 39, 1895.
Gonimbrasia Karsch, Ent. Nachrichten, XXII Jahrg., p. 247, 1896.

[Type of genus, *G. nictitans* (Fabr.), according to Kirby.]

Imago.—One ♀, one ♂. Head in front moderately broad, the sides nearly parallel; the vestiture on the front a little shaggy. Antennæ of ♂ consisting of 27–28 joints, those in the middle being rather long, nearly twice as much so as thick; bipectinate, the two sets of pectinations rather far apart; the tip filiform; the last five joints with vestigial pectinations; ♀ about 25 joints, well pectinated, the branches of the basal pair nearly twice as long as the joints themselves and the tip (5–6 joints) simple. Palpi extending to the front; the third joint distinct, quite long.

Thorax moderately thick, its vestiture rather dense and shaggy.

Fore wings moderately wide, in ♂ falcate, costa well arched (more so than in ♀) to the subacute apex; the outer edge slightly excavated below the apex; outer and inner edges of about the same length.

Hind wings squarish, costa full and convex at base; apex subrectangular; outer edge subangulated in the middle, decidedly more so in ♂ than ♀; inner angle well rounded; the abdomen only reaching about one-half way to the hindermost edge of wing.

Venation: That of the fore wings is nearer to *Imbrasia* than to *Nudaurelia*, and differing in this respect from *Nudaurelia*, i. e., the anterior discal vein originates inside of the origins of veins III_2 and III_3 while in *Nudaurelia* it originates outside; in *Imbrasia*, the discal and two other veins (III_2 and III_3) originate at the same point. Also veins II_1, II_2, and II_3 are well developed, and are as in *Imbrasia*.

The discocellulars are directed a little inward instead of outward, as they are in *Imbrasia*. In the hind wings the venation is nearly as in *Imbrasia*.

Markings: There is no ocellus in the fore wings, only a small D-shaped clear area, while on the hind wings there is a large compound ocellus, as in *Imbrasia*.

This genus in its venation and markings is more closely allied to *Imbrasia* than any other, though the hind wings of the male are rounded much as in the female of *Imbrasia*. The ♀ hind wings are much more convex and more rounded than in ♀ *Imbrasia*. It is apparently a more primitive type than *Imbrasia*, as the larva, when discovered, may possibly show. [Antennæ of female not compared, owing to their absence from Dr. Packard's ♀ *Imbrasia*.]

The genus entirely differs in venation from *Bunaea* as here restricted, or from *Thyella*. *G. hyperbius* (Westwood) appears to belong to this genus, as the ♀ hind wings are full and rounded, and the markings are much as in *G. alopia*. [*G. hyperbius* is the type of *Cinabra* Sonthonnax, 1903.]

Geographical distribution.—West Africa (Sierra Leone), genus extending across to Matabele Land, southeast Africa (*G. hyperbius*), or from lat. 10° to 20° S.

GONIMBRASIA ALOPIA (Westwood).

Plate XLIV, fig. 4.

Saturnia alopia Westwood, Proc. Zool. Soc. London, 1849, p. 55.
Bunaea alopia Walker, Cat. Lep. Het. Brit. Mus., V, p. 1231, 1855.
Gonimbrasia alopia Kirby, Syn. Cat. Lep. Het., I, p. 753, 1892.
Nudaurelia alopia Sonthonnax, Annales Lab. d'Etude de la soie, X, p. 26, Pl. X, fig. 2, 1901.

Sonthonnax regards *G. intermiscens* (Walker) as a synonym.

Imago.—Two ♂, one ♀. Body and wings scotch-snuff yellow, with an olivaceous tinge, and dusted over with fine dense brownish scales. A narrow white prothoracic collar. Antennæ of ♂ with 27–28 joints. Westwood states that there are "34 rays on each side," making 17 joints with double pectinations.

Fore wings with a distinct basal line which is smoky brown within and whitish pink-gray without, widening on the costa, especially just behind the costa (not so zigzag as in the ♀). Extradiscal lines nearer the discal spot than to the outer edge, pink whitish gray, inclosing a

narrow dark brown line in the inner edge. Discal spot triangular, clear, becoming suboval, more in ♂ than ♀, where it is distinctly D-shaped; it is small (about 2 by 1 mm.).

Hind wings concolorous with the fore wings, with a whitish discoloration at the base; the base and costal region suffused with deep reddish pink, extending to the discal spot and flooding the basal line, which is broad, diffuse. Extradiscal line broad, smoky, dark, pale within, and bordering the discal ocellus, which is very large, round, very slightly oval (10 by 8½ mm.); the center triangular, not so wide, distinct or clear as in the fore wings, this clear space situated in a deep snuff-yellow area inclosed by a black ring which is encircled by a much broader pale olivaceous pink-gray ring. Under side of the wings washed with hoary pink, especially toward the apex on each side of the extradiscal line; basal line obsolete on each side. Discal spot distinct on the fore wings, obsolete on the hind wings, the clear central spot more distinct than the rest of the ocellus.

Expanse of the fore wings, ♂ 100 mm.; ♀ 82 mm.
Length of one fore wing, ♂ 45 mm.; ♀ 40 mm.
Breadth of one fore wing, ♂ 24 mm.; ♀ 20 mm.
Length of a hind wing, ♂ 32 mm.; ♀ 27 mm.
Breadth of a hind wing, ♂ 27 mm.; ♀ 20 mm.

Geographical distribution.—Sierra Leone; the ♂ pupated in July, 1895, emerged January, 1896, in England. No. 19190, Schaus collection. American Museum of Natural History, New York.

GONIMBRASIA ACETES (Westwood).

Saturnia acetes WESTWOOD [Proc. Zool. Soc. Lond., 1849, p. 53].
Bunaea acetes MAASSEN and WEYMER, Beiträge Schmett., figs. 108–111, 1885.
Bunaea acetes KIRBY, Syn. Cat. Lep. Het., I, p. 752, 1892.
Gonimbrasia acetes ROTHSCHILD, Nov. Zool., II, p. 38, 1895.

GONIMBRASIA ERYTHROTES (Karsch).

Bunaea erythrotes KARSCH.
Gonimbrasia erythrotes ROTHSCHILD, Nov. Zool., II, p. 38., 1895.

THYELLA Felder.

[*Antheraea* WALKER, in part, Cat. Lep. Het. Brit. Mus., V (1855), p. 1244.]

[It is impossible to use *Thyella* in the sense here employed. The name was first used by Wallengren (Oefv. Vet. Akad. Forh. vol. 15, p. 141; 1858) for a genus to include *T. nyctalops* Wallengr., which was designated as the "species typica," and was said to be allied to *Bunaea alcinoë* (Cram.), as I am informed by Dr. G. M. Allen. There is also a *Thyella* Desv., 1863 (Diptera) and a *Thyella* Adams, 1865 (Mollusca); both prior to Felder's use of the name.]

Imago.— ♂ and ♀. Head broad in front, much as in *Gynanisa*, and *Acanthocampa belina*. Male antennæ broad, plumose, subfiliform at tip, the pectinations thicker than in *Gynanisa*, those of both pairs of the same length, the joints a little longer than thick. Palpi very broad, with long hairs below, third joint minute, scarcely visible, porrect or depressed, reaching a little beyond the front. No maxillæ. Thorax stout, a well-defined prothoracic collar, as in *Gynanisa*. Fore wings as in *Gynanisa*, but a little more curved on the costa toward the apex, but the wing is not falcate, and is a little shorter and broader than in *Gynanisa;* the outer edge not excavated, and the edges of neither wings are scalloped. Hind wings with the apex not so round as in *A. belina*, not produced toward the apex, and the outer edge is full and convex; they reach well beyond the end of the ♂ abdomen, but in ♀ only to the end. The hairs on the thorax and on the inner edge of the hind wings are very long and shaggy.

Venation: Vein II_1 arising opposite or within the anterior discal vein, and very near the common stalk of veins II_2 and II_3; vein III_2 either nearly in the middle of the discal cell, or arising at a common point of origin of veins III_1, III_2 and the anterior discal vein; the discal cell narrow. Hind wing with discal cell rather narrow. Discal veins situated exactly midway between the base and outer edge of the wing; and vein III detached and nearly independent.

Markings: Olive or ashen fawn color, with similar large ocelli on each pair of wings (*tyrrhaea*), inclined to be oval, those of the hind wings nearly round. On the under side they are much smaller, especially those of the hind wings. The basal line on the fore wings is very deeply zigzag, the extradiscal line is composed of large coarse scallops on both wings, and the ground color tends to be blackish brown. Fore tibial odoriferous sack concealed by the tibial hairs, but when denuded found to be large and five-sixths as large as the tibia itself and nearly as thick. The two fore tibial spines much shorter than in *belina*. This genus has been confused with *Antheraea*, but structurally is near *Acanthocampa*, *Gynanisa*, and *Nudaurelia*. The genus differs from *Nudaurelia* in the plumose antennæ, the pectinations being slender, long and densely ciliated, in venation as vein II_1 arises close to the stalk of II_2 and II_3, while in *Nudaurelia dione* II_1 arises much nearer the base of the wing, far inside of the ocellus. Also, *Nudaurelia* has subfalcate fore wings, the ocelli are more advanced or specialized, and the head is broader in front.

Geographical distribution.—An Ethiopian genus (Natal).

Genitalia: Suranal plate triangular, moderately wide; as in *Gynanisa* and *Acanthocampa belina*, no lower claspers are present. The upper pair well developed, much as in the type of *Acanthocampa belina* and *Gynanisa isis*, being seen sideways broad, triangular, ending in a mucronate process; seen from above and beneath, a clasper is about one-third as wide as long.

THYELLA TYRRHÆA (Cramer).

Plate XXXII, fig. 2; XXXV, fig. 3; CVIII, figs. e–h.

[*Attacus tyrrhaea* Cramer, Pap. Exot., I (1775), pl. 46 A.]

Imago.—One ♂. Ground color of the body and wings olive fawn-brown. Fore wings with a distinct white basal line with two sharp angles, a small one with the apex in the discal cell, the other a large acute angle ending in the middle of the wing between the ocellus and the inner edge. From the costal ending of the line a narrow white line passes to the ocellus and becomes confluent with it. An outer very regularly scalloped heavy dark brown line consisting of seven scallops, all of the same shape, the largest being toward the inner edge of the wing; the scallops are edged within with white, and very broadly so with white on the outside, the outer edge of the white line being even. Outer edge of the wing colored like the rest of the wing, ocellus centered with a roundish clear spot in a central pale sable-brown area, inclosed by a black ring; then a pale sable-brown ring, outside of which is a white line, which behind widens out and sends a line to the basal line and in front of the ocellus.

Hind wings pink at the base, otherwise colored as in the fore wings; outer line with shallower scallops, and less white outside than on the fore wings. Ocellus as in the fore wings, but larger and rounder.

Under side of the wings with pink along the hinder part of the base of the wings, extending to the extradiscal line and to near the costal edge. Ocellus nearly as large as above. Hind wings with more gray scales than above; the ocellus one-half as large as above, and only the snuff yellow center left, and an outer black ring.

Expanse of the fore wings, ♂ 114 mm.
Length of a fore wing, ♂ 57 mm.
Breadth of a fore wing, ♂ 32 mm.
Length of hind wing, ♂ 44 mm.
Breadth of hind wing, ♂ 32 mm.
Ocellus of fore wing, 11½ by 8 mm.
Ocellus of hind wing, 13 by 10 mm.

[*Geographical distribution.*—South Africa.]

ACANTHOCAMPA Packard.

[*Acanthocampa* Packard, Journ. N. Y. Ent. Soc., X (1902), p. 100.]

ACANTHOCAMPA BELINA (Westwood).

Plate XXXII, figs. 6, 7; CVI, figs. d–g.

Saturnia belina Westwood, Proc. Zool. Soc. London, 1849, p. 41, Pl. VIII, fig. 2.
Antheraea belina Walker, Cat. Lep. Het. Br. Mus., V, p. 1241, 1855.
Antheraea belina Kirby, Syn. Cat. Lep. Het., I, p. 758, 1892.
Nudaurelia belina Rothschild, Novitates [Zoologicæ].
Nudaurelia belina Sonthonnax, Annales Lab. d'Etudes Soie, X, p. 24, Pl. IX, fig. 2, ♂, 3, ♀ 1901.
Antheraea huebneri Kirby, Trans. Ent. Soc. London, 1877, p. 20.

[*A. belina* is the type of the genus.]

Imago.—One ♂, one ♀. Body and wings uniformly rather light grayish fawn. Head and thorax concolorous, but the basal half of the abdomen is of a pinkish tinge. Collar broadly edged with white.

Fore wings of the same outline as in *tyrrhaea*, but with quite different markings; basal line broad, white, on the inside lined with brown, and situated a little nearer the discal spot than the base of the wing; it is somewhat curved, with two faint scallops, one in the discal space, the other on vein IV, the scallops more marked in ♂ than ♀. Extradiscal line white, like the basal, brown externally, slightly sinuous, but not scalloped, and ending on the outer fourth of the costa. Ocellus of fore wing an elongated half circle, like a solid D, the inner side of the mark straight, the outside well rounded, less than half as large as the ocellus of *tyrrhaea*, more elongated in ♀ than ♂, a central clear half round space, edged with reddish brown and black brown, with an outer circle of whitish gray.

Hind wings with a broad diffuse whitish basal line, and a large ocellus, the center of which is small, clear, surrounded by a broad soft brown fawn (almost brown pink) ring, a narrower dark brown ring, and a wide pale grayish-white ring. Extradiscal line broad, whitish and brown, curved outward opposite the ocellus which it nearly touches. Base of wing and costal edge pink, the pink shade extending to the extradiscal line.

Under side of the wings; the ocellus of the fore wing is as above, small, but without the outer white line in the ♂, though it is present (?) in the ♀. Hind wings with no ocellus except the clear space, of the same size as above. No basal line, but the extradiscal line is common to both wings.

Expanse of the fore wings, ♂ 108 mm.; ♀ 100 mm.
Length of fore wing, ♂ 54 mm.; ♀ 52 mm.
Breadth of fore wing, ♂ 30 mm.; ♀ 28 mm.
Length of hind wings, ♂ 39 mm.; ♀ 35 mm.
Breadth of hind wings, ♂ 30 mm.; ♀ 29 mm.
Ocellus of ♂ fore wings, 5 by 5 mm.; hind wings, 15 by 13½ mm.
Ocellus of ♀ fore wings, 5 by 4 mm.; hind wings, 11 by 10 mm.

Genitalia: Suranal plate spine-like, long acute, compressed, subcultiform, reaching nearly to the end of the claspers; these are stout, seen sidewise, triangular; seen from above or beneath, rather narrow and moderately curved. Penis forms a cylindrical subacute style-like process.

Geographical distribution.—"Port Natal and Zoolu" (Westwood); not rare at Pretoria during October and November (Distant), Natal (Doll). Durban, October 29, 1901, bred (Queckett).

Rothschild has stated that *A. huebneri* Kirby is a synonym of this species, and comparison with his description enables me to verify his statement.

Larva.—Length 82 mm., width of head 7 mm., the head being about half as wide as the prothoracic segment; it is rounded, of the same shape and with the same kind of fine microscopic granulations as in *Nudaurelia*. Prothoracic plate with the surface rugose, with scattered long fine hairs, but none on the front edge, and no vestigial median tubercles; on each side of the segment on the front edge and in front of the spiracle is a moderately large tubercle with five or six scattered setiferous warts; over the base of each thoracic leg is a conical tubercle. Below, above, and in front of the tubercles are numerous pearly fungoid warts, three or four of these directly beneath the spiracle being bright red, as is a similar group on the two other thoracic segments.

The spines are short and stout, acute, and directed backward, but not curved; all the dorsal spines on both thoracic and abdominal appendages of uniform size and shape, and all black. The median spine on eighth abdominal segment is no longer and but little larger than the others, and either deeply or slightly forked. Infraspiracular spines conical, short; those on the second and third thoracic segments over the base of the legs conical and as high as broad at the base. The spines are about half as large as in *Nudaurelia*.

The segments almost entirely covered with bluish green or pearly warts, usually densely crowded above and on the sides, and covering the under side of abdominal segments 1, 2, 7, and 8.

Suranal plate with some warts at base, and anal legs with three on each side at base. The plate is of nearly the same shape as in *Nudaurelia* (*N. wahlbergii* and *dione*), but a little more rounded behind than in *N. wahlbergii* and with more distinct though minute setiferous tubercles or warts.

Body black; a median row of irregular black spots and a similar row on each side, a spot to each segment. It varies in the crowded condition of the pearly fungoid warts; in one of the three examples they are scattered and much fewer in number. This is 60 mm. long, but last stage, as head is same width. Natal; Lieut. Col. J. M. Fawcett. [C. Oberthür (Etud. Lep. Comp., IV bis, 1910) discusses this species, as *Nudaurelia belina*, with good photographic figures. He distinguishes a new variety *junodi*.]

ACANTHOCAMPA ZAMBESINA (Walker).

Plate CVIII, figs. a–d.

Bunaea zambesina Walker, Cat. Lep. Het. Brit. Mus., XXXII, p. 523, 1865.
Thyella zambesia Felder, Reise d. Novara, Lep., IV, Tab. LXXXV, fig. 5.
Antheraea zambesia Maassen and Weymer, Beiträge z. Schmett., V, fig. 96, 1886.
Antheraea zambesia Kirby, Syn. Cat. Lep. Het., I, p. 758, 1892.
Nudaurelia zambesina Rothschild, Nov. Zool., II, p. 43, 1895.
Acanthocampa zambesina Packard, Journ. N. Y. Ent. Soc., June, 1902.

Imago.—One ♀. Head, ♀ antennæ and palpi as in *A. belina*, though the ♀ antennæ have longer vestigial branches. The fore wings a little more acute; outer edge a little more excavated, the wings being subfalcate; hind wings of the same shape as in *A. belina*. It differs from *A. belina* in the lines and ocelli, the ground color being uniformly of a peculiar elk gray.

Fore wings: Basal line very different from that of *A. belina* in being nearer the insertion of the wing, and being much curved outward; brown, edged externally with whitish. Extradiscal line as in *A. belina*, but more scalloped, especially toward the costal edge; ocellus less D-shaped (7 by 5 mm.) and more completely circular; formed of a round circular black ring, and an elk-gray broad ring between this and the central clear spot, which is D-shaped, just as in *A. belina;* outside of the black circle is a broad gray ring, and still farther outside a narrow white ring, interrupted in front and behind.

Hind wings elk gray, with a much larger discal spot and rounder than in *A. belina* (20 by 19 mm.), and the black ring is nearly square (19 by 19 mm.) inside, not being regularly oval, cylindrical, as in *A. belina*, while the center is not so yellow, being more of a fawn color, but the central clear space is narrower. Extradiscal line not so heavy as in *A. belina*, and situated farther from the ocellus. The pale pinkish middle of the wing inclosing the ocellus is deeper in tone than in *A. belina*.

Underside of the wings much as in *A. belina*, but the common extradiscal line is much more scalloped than in *A. belina*.

Expanse of fore wings, ♀ 120 mm.
Length of one fore wing, ♀ 62 mm.
Breadth of one fore wing, ♀ 35 mm.
Length of hind wing, ♀ 42 mm.
Breadth of hind wing, ♀ 35 mm.

Geographical distribution.—"Zanzibar" (Staudinger), Schaus collection, American Museum of Natural History, New York.

Larva.—It is figured by Maassen and Weymer, figs. 96, 97, and 98. It agrees in general with that of *Nudaurelia dione*, the body being cylindrical, armed with numerous straight stiff unbranched sharp spines.

Pupa.—The pupa is figured in the same plate. It is elongated, and the abdomen ends in a point. [C. Oberthür (Etud. Lep. Comp., IV bis, 1910) discusses this species, as *Thyella zambesia*, giving good photographic figures. He separates two new races as *rectilinea* and *zanguebarica*.]

ACANTHOCAMPA FELDERI (Rothschild).

Nudaurelia felderi Rothschild, Nov. Zool., II, p. 42, 1895.

Imago.—"Wings very similar to red varieties of *N. belina* (Westw.), but without the ocellus on the fore wings, there being only a small square vitreous spot. Another difference is the very broad white border to the ocelli of the hind wings.

"Expanse 5½ inches = 140 mm. Habitat, Bogos, Abyssinia."

[Mr. J. H. Watson has kindly sent an abstract of the treatment of *Acanthocampa* and allied genera by Aurivillius in Arch. f. Zool., 1904, p. 18. Aurivillius here recognized two genera as follows:

(1) *Gonimbrasia* Butler. Type *nictitans* (Fabr.). With the anterior tibiæ short, shorter than the tarsi, and armed at the end with two spines; joints of antennæ almost simple. This includes *Acanthocampa* Pack. and *Angelica* Distant. The following species are referred to it: *belina* Westw., *osiris* Druce, *said* Oberth., *zambesina* Walk., *tyrrhea* Cram.

(2) *Bunaea* Hübner. Type *alcinoë* (Cram.). Anterior tibiæ scarcely shorter than the tarsi, and not armed at end; joints of antennæ with four teeth. Includes *Thyella* Wallengr. Here are placed the species *caffraria* Stoll, *aslauga* Kirby, *goodii* Holland, *hersilia* Westw., and *oubie* Guér.

Angelica Distant, 1903, was based on *zambesina*, which is placed above in *Acanthocampa*. Oberthür (1910) refers it to *Thyella*, but it is not the original genus of Wallengren, which Aurivillius correctly associates with *Bunaea*. Judging from the markings (compare Plates CVI and CVIII) *belina* stands apart from *zambesina* and *tyrrhea*, these latter seeming to be congeneric. On this basis *Angelica* might possibly be separated from *Acanthocampa*, but Oberthür's *zambesina*, subsp. *rectilinea*, approaches *belina* in its markings.]

BUNAEA Hübner.

Bunaea Hübner, Verzeichniss bek. Schmett., p. 154.
[*Bunaea*] Rothschild, in part, Nov. Zool., II, p. 38, 1895.

Imago.— ♂ and ♀. Head not so prominent as in *Salassa*, the front not wide, and it narrows toward the labral region; the scales are not erect, but laid flat on the surface. Antennæ of male plumose, wide, the joints rather long, flattened, and scaled above, with long pectinations provided with long dense cilia, ending a little before the subfiliform tip; the basal and distal pectinations long and slender, and of equal length; there are 33 joints, the last three with vestigial branches; female antennæ with short pectinations extending almost to the end, which bears long setæ; the distal ones tooth-like, one-third as large and long as the basal ones.

Palpi unusually small and short, depressed, not reaching to the front, blunt at the end, and the third joint not distinct; when denuded, a button-like short round third joint is present. Thorax stout.

Legs rather stout, all the tibiæ without spines. For tibia when denuded rather thick, not bearing any terminal spines; the odoriferous sack or nartheca lanceolate-oval, swollen in the middle, the end slender and prolonged; about two-thirds as long as the tibia itself; at the base overlapping it is a broad flat ovate secondary sack, which is as wide as the tibia. A similar scale-like process or sack is observable in *Nudaurelia cytherea*.

Fore wings falcate in ♂, scarcely so in ♀; costa straight to near the apex, where it is well curved; apex acute; the outer edge incurved. Hind wings triangular, with the apex almost pointed, the outer edge curved in ♂, nearly straight in ♀; inner edge somewhat rounded,

with no lobe, such as is present in *Lobobunaea*. Abdomen not reaching to the end of the hind wings.

Venation: Vein II_1 [III_1 in revised nomenclature] arising opposite the end of the discal cell, i. e., opposite the root of the anterior discal vein and midway between the root of the stalk of II_2 and II_3 and that of veins III_1 and III_2. Hind wings with discal veins situated slightly beyond the middle of the wing, while vein III_2 arises close to inside of root of anterior discal vein.

Markings: Basal and extradiscal lines on each wing. A discal spot on the fore wings, large, squarish, clear, with the outer edge oblique, with sometimes a small supplementary one in the next cell toward the costa. Hind wings with a large ocellus, with a large clear central area.

Larva.—Body cylindrical, very near *Nudaurelia;* spines large, long, straight, sharp, with no setæ; the median one on eighth abdominal segment scarcely thicker than the others, but forked, the split not very deep; otherwise the larva is much as in *Nudaurelia wahlbergi.*

This genus differs from *Lobobunaea* in wanting the lobe on the inner end of the hind wings, and in the venation, vein I arising opposite the end of the discal cell, while in *Lobobunaea* the same vein arises at the middle of the cell. By Hübner *caffraria* is made the type, the only other species mentioned being *B. alcinoë* Cramer, which is the same species.

To the genus *Bunaea* Rothschild refers 16 species; but from it I have eliminated *B. alinda, B. tyrrhena, B. irius* (*epithyrena*), *B. jamesoni, B. phaedusa,* and *B. eblis.* As to the generic position of *B. melinde, senegalensis, cervina, natalensis,* and *cleopatra,* this can only be determined by an examination of the venation.

Geographical distribution.—Ethiopian realm. Southwest Africa.

BUNAEA CAFFRARIA (Stoll).

Plate XXXII, fig. 8; XXXV, fig. 4.

Bunaea caffraria Hübner, Verzeichniss bek. Schmett., p. 154.
[*Attacus caffraria* Stoll, Suppl. Cram. (1791), pl. 31. fig. 2.]
[*Thyella nyctalops* Wallengren, Wien. Ent. Mon., IV (1860), p. 167.]

Imago.—Two ♂, one ♀. Head, thorax, and base of both pairs of wings brick-red, including base of abdomen, the rest of the wing and abdomen pale fawn color. A broad diffuse white line is common to both pairs of wings. Extradiscal line in both wings interrupted by the discal spots and accompanied within by a white line, greatly expanding on the costa of the fore wings. Beyond this line the wing is hoary, but the outer edge is clear fawn color. Discal spot an irregular oblong transparent spot, the outer edge of which is oblique. (In one specimen there is a small supplementary clear spot in the cell in front; in the two others, one ♂, one ♀, it is wanting.)

Hind wings with the basal line in ♂ confluent with the hoary fawn around the discal spot, but in ♀ it is free, and does not pass very near it. Discal spot deep orange yellow with a round center, the orange encircled with dark brown and that by whitish.

Under side fawn color frosted over with hoary scales; the discal spot on the fore wings as above, but that of the hind wings is only represented by a half-round transparent spot.

Expanse of fore wings, ♂ 112 mm.; ♀ 125 mm.
Length of a fore wing, ♂ 58 mm.; ♀ 64 mm.
Breadth of a fore wing, ♂ 30 mm.; ♀ 33 mm.
Length of hind wing, ♂ 40 mm.; ♀ 38 mm.
Breadth of hind wing, ♂ 29 mm.; ♀ 33 mm.

Geographical distribution.—[South Africa.]

[Rothschild lists ab. *punctigera* (Wallengr.) and ab. *angasana* (Westwood). Jordan (1910) has described a subspecies *nubica* from the Blue Nile.]

[C. Aurivillius, in litt. to Dr. Packard, December, 1901, states that *B. alcinoë* is very nearly allied to *B. caffraria,* and may be only a local race of that species. However, Charles Oberthür

(Étude Lep. Comp., 1910) has discussed this question at length, reproducing the original figures, which certainly appear to represent distinct species.[1]]

[The larva of *B. caffraria* has been described and figured by Fawcett, Trans. Zool. Soc. Lond., XV (1900), p. 303, Pl. XLVII.]

Larva.—Length 85 mm. Head of the usual shape, black; surface rugose all over, and the groups of fine granulations arranged in irregular lines; the head is about two-thirds as wide as the prothoracic collar. Body of the usual cylindrical shape and proportions. Prothoracic collar or plate as wide as the outside measurement between the spines of the supraspiracular rows of the second thoracic segment. There is a little more of an inequality in the length of the dorsal spines than in *Nudaurelia* or *Acanthocampa*, those of the second thoracic segment being fully as long as those of the first abdominal segment, while those of the last three segments of the abdominal region are slightly shorter and a little more curved; the thoracic spines are black, while those of the abdominal segments are white; all the thoracic spines are black, except the two infraspiracular ones (lower or surpedal) on the third thoracic segment. All of the abdominal spines are ivory white, and the skin around the base is white, especially on the two rows below the spiracles, the white fold or ridge extending from the base of the spine up to and almost in front of the spiracle.

The median spine on the eighth abdominal segment is rather slender and no thicker than the two dorsal spines of the ninth abdominal segment; it is divided for about one-fifth of its whole length, and the two tines or branches are slender and sharp; the horn is no longer than the spines next to it.

The dorsal spines are smooth, with no setæ, but those on the two lowest rows on the side below the spiracles bear six to seven fine black setæ, one or two near the tip arising from sharp tubercles and being dark-tipped spinules like the tip end of the spine. All the legs, thoracic and abdominal, black.

Suranal plate unarmed, the surface rather coarsely rugose and with scattered warts giving rise to short black hairs. Anal legs also rugose and sparsely setose. Spiracles bright orange and encircled with bright orange. This is a very showy and powerfully armed caterpillar, more so than any other Bunaean larva, or indeed any other Lepidopterous larva known to me. It is so well protected from the attacks of lizards or birds that its colors are undoubtedly warning.

BUNAEA TRICOLOR Rothschild.

Bunaea tricolor Rothschild, Nov. Zool., II, p. 38, Pl. X, fig. 4, 1895.

Imago.—One ♂. "Fore wings deep blackish gray, crossed about an inch from the outer margin by a white transverse band, and at the apex of the cell there is a small vitreous spot; costa white.

"Hind wings deep blackish gray. In the center of the wing is an ocellus with a tiny vitreous center; round this is a broad ring of bright orange red, followed by a black and then by an outside white ring. Beyond the ocellus is a broad white transverse band, through the center of which runs a narrow black line. Head, thorax, and abdomen chocolate rufous. Underside brownish-gray.

"Expanse 5½ inches = 140 mm."

This appears to be generically allied to *B. caffraria*.

Geographical distribution.—Bogos, Abyssinia (Rothschild).

[1] [Oberthür, in the work cited, also discusses what he calls *B. caffra* Boisduval, with several varieties or races (*barbertonia*, *debeeri*, *zanguebarica*, and *durbania*). However, the name *caffra* was simply a new name for *caffraria* (first used by Hübner), and Oberthür's "*caffra*" must stand as *Bunaea barbertonia* (C. Oberthür).]

BUNAEA ALCINOË (Stoll).

Plate XXXII, fig. 9; CVII, fig. a.

BUNAEA AURICOLOR (Mabille).

Saturnia (*Bunaea*) *auricolor* Mabille, Bull. Soc. Philom., (7) III, p. 139, 1879.
Saturnia (*Bunaea*) *fuscicolor* Mabille, Bull. Soc. Philom., (7) III, 1879.
Bunaea aslauga Kirby, Trans. Ent. Soc. London, 1877, p. 18.
Saturnia diospyri Mabille, Ann. Soc. Ent. France, (5) IX, p. 316, 1880.
Bunaea plumicornis Butler, Cistula Ent., III, p. 18, 1882.
Bunaea aslauga Waterhouse, Aid Ident. Jis, II, tab. 142, fig. 1, 1889.
Bunaea aslauga Kirby, Syn. Cat. Lep. Het., I, p. 751, 1892.
Bunaea auricolor Rothschild, Nov. Zool., II, p. 38, 1895.
[*Bunaea aslauga* Oberthür, Etud. Lep. Comp., IV bis (1910), p. 38, f. V.]
[*Saturnia diospyri* Oberthür, Etud. Lep. Comp., IV bis (1910), p. 38, f. X.]

[*Geographical distribution.*—Madagascar.]

Rothschild has reduced these four nominal species as above to synonyms of *B. auricolor*. [C. Oberthür (1910) regards *B. aslauga* and *B. diospyri* as distinct species.]

BUNAEA ARENOSA Staudinger.

♂. Not a *Bunaea*. Antennæ plumose, extreme tip filiform; body and wings uniformly yellow ocher. Fore wings falcate (70 mm. long), costa much curved, outer edge excavated. Hind wing rather long. Palpi small, not reaching the front. Four lines, two intradiscal obscure ones, an oblique brown extradiscal to apex, and a submarginal broken brown line forming a series of about six to seven spots. Ocellus of fore wing an elliptical broad brown ring inclosing a small oval clear spot; on hind wing nearly twice as large, the brown ring wider, a broad straight brown band inside but touching ocellus; a zigzag extradiscal line curving in on inner edge and a submarginal series of six to seven spots as on fore wing. Beneath the same but suffused with brown, and ocelli smaller; clear space the same size, but ring narrower on both wings.

[*Geographical distribution.*—Cameroons].

[BUNAEA MELOUI Riel.

C. Oberthür (Etud Lep. Comp., 1910) has figured several forms of this species raised from pupæ obtained at Kaolack, Senegal, by M. Gaston Melou. The variation not only in markings, but in wing form, is astonishing; and as the insects, although raised from larvæ, were not apparently bred from known parents, we may suspect a mixture of species, or possibly a case of hybridization. Supposing all these *meloui* to be truly conspecific, Oberthür suggests that these, with *B. epithyrena, melinde, pallens* and *inornata*, may all be variations or races of one species. Rothschild considered *epithyrena* a synonym of *irius* (Fabr.), which Packard excludes from *Bunaea*.]

[BUNAEA VINOSA Riel.

Plate CVII, fig. b.]

ANTHERINA Sonthonnax.

Saturnia Boisduval, Faune Ent. de Madagascar Lep., p. 89, 1833.
Antheraea Walker, Cat. Lep. Het. Br. Mus., V, 1855.
Antheraea Maassen and Weymer, Beiträge Schmett., III, fig. 54, 1873.
Antheraea Kirby, Syn. Cat. Het., I, p. 758, 1892.
Antherina Sonthonnax, Annales des Laboratoire d'Etude de la Soie, X, p. 56, 1901.

Imago.—One ♀. Front of head a little narrower, and the hairs longer, more shaggy, not so closely cropped as in *Nudaurelia* (*cytherea*), not narrowing quite so much toward the labial region. Antennæ "broadly bipectinated nearly to tip," those of the ♀ also bipectinate, and with pectinations nearly as long as in ♂. Palpi much as in *Nudaurelia*, but still longer, especially the third joint, which is unusually long and well developed, when denuded seen to be long and slender. Maxillae minute, slender, white, each appendage separate, short, not so long as the

palpi, reaching only to near the end of the second joint. Thorax and abdomen with the squamation not so long and shaggy as in *Nudaurelia;* collar not so distinct as in that genus.

Fore wings subfalcate, a little shorter and wider than in *Nudaurelia;* costa a little more arched at apex, which is more obtuse than in *Nudaurelia.* Hind wings much more rounded, apex more obtuse, and the outer edge less oblique than in *Nudaurelia;* the wings extend somewhat beyond the end of the abdomen.

Venation: Vein II [III in revised nomenclature] and its branches as in *Nudaurelia,* II_2 wanting as in that genus; the vein arises at a point situated (costally) in front of the middle of the discal cell, and close to the very short common stalk of veins II_3 and II_4. Vein III_2 not detached to form an independent vein, not so much detached as in *Nudaurelia;* the two discal veins forming a fine straight line; the discal cell broader and shorter than in *Nudaurelia.* In the hind wings the veins beyond the broad discal cell are shorter, and the veins and ocellus situated nearer the outer edge of the wing than in *Nudaurelia.*

Markings: They differ from those of *Nudaurelia* (*cytherea*) in the ocellus of the fore wings being solid, with no clear space, and only a fine dark outer ring, and a fine white semicircular line on the inside. The ocellus of the hind wing is large, round, not oval, with a minute clear oval space, a wider dark outer ring and a pale steel blue inner semicircular line. The basal and extradiscal lines white, not scalloped. Costal edge of fore wings and the prothorax whitish gray.

Fore tibia stout, not spined at the end; with dense bushy hairs, ♂ odoriferous sack usually narrow, cultriform, acute, about two-thirds as long as the tibia itself.

Cocoon.—Cocoon forming a thin silken network, through the meshes of which the pupa can be seen. The genus is placed by Sonthonnax between *Thyella* and *Melanocera,* but it seems to approach near to *Nudaurelia.* It is readily distinguished from *Nudaurelia* by the widely pectinated ♀ antennæ, the longer palpi, and also by difference in the venation, including the absence of vein II_2 (second subcostal vein), and the shorter more rounded wings. The characters given by Sonthonnax are with the exception of the well-pectinated ♀ antennæ, those of the markings and coloration; but such distinctions are not as a rule very safe to found a genus on, as the species vary in these respects, and they should only be considered in connection with more fundamental structural characters. It will be interesting to learn whether the larva enters the earth to pupate or spins a slight cocoon above ground, and whether the abdomen of the pupa ends in a well-developed cremaster. The pupa of *Nudaurelia dione,* the only species whose transformations are known, is subterranean, according to Sonthonnax, the larva spinning no cocoon.

Geographical distribution.—Malagasy region. The single known species of the genus is confined to Madagascar.

[*A. consanguinea* Distant, from the Transvaal, was described in 1903.]

ANTHERINA SURAKA (Boisduval).

Plate XXXVII, fig. 5.

[*Saturnia suraka* BOISDUVAL, Faune Madag. Lep., (1833), p. 89, pl. 12, fig. 4.]

Imago.—One ♀. Head deep orange-yellow; thorax paler, collar all white-gray, extending along the costa. Fore wings uniformly pale yellowish buff-brown; basal line broad, white, enlarging on the costa, about midway between the base of the wing and the ocellus. Extradiscal line broad, white, not scalloped, running near the discal spot and much curved around to the costa, ending in the outer third, where it expends and meets a pink hoary costal patch, ending on the costa just before the apex. Ocellus solid ocher brown, of a deeper hue than the rest of the wing, and surrounded on the outside by a narrow thread-like dark semicircle, and within by a pink-white one.

Hind wings paler, more yellow ocher than above, pink on the inner and costal side of the ocellus; the extradiscal line broad, consisting of three shades of pink, the middle shade whitish pink; the line curves around to unite with the basal one, and forms a large loop inclosing the ocellus. The latter is centered by a minute clear spot, situated in a solid deep ocher-yellow

field, encircled by a dark ring, which is thickened on the inner side and incloses on the inner side a pale blue semicircular line edged on the inner side with dark brown scales.

Under side of the wings of both pairs more gray than above, especially on the hind wings. The discal spots beneath exactly the size and colors of those of the hind wings of the upper side; that on the hind wing is obsolete, represented by a little white spot.

Expanse of fore wings, ♀, 109 mm.
Length of fore wing, ♀, 58 mm.
Breadth of fore wing, ♀, 34 mm.
Length of hind wing, ♀, 41 mm.
Breadth of hind wing, ♀ 37 mm.
Ocellus of fore wing, ♀, 6 by 6 mm.; beneath, 7 by 7 mm.
Ocellus of hind wing, ♀, 9.5 by 9.5 mm.

This species which might be mistaken for a *Nudaurelia*, may be recognized by its rounded, broad wings, by the white lines, by the solid, opaque ocellus of the fore wings, while that of each hind wing is wanting, as well as the broadly pectinated ♀ antennæ.

Cocoon.—An oval network formed of thin silky tissue; yellowish gray, slightly lustrous; measuring 6–7 [67 ?] mm. in length (Sonthonnax).

Geographical distribution.—Madagascar and Comores (Sonthonnax), collected at Lurakak. Madagascar (J. Doll).

NUDAURELIA Rothschild.

Antheraea [Walker, Cat. Lep. Het. Brit. Mus., V (1855), p. 1239 (in part)].
[*Nudaurelia* Rothschild, Nov. Zool., February, 1895, p. 41.]

Imago.— ♂ and ♀. Head with the front rather full and wide, inclined to be wider in front than usual, and the front is rather closely cropped; when denuded broad and flat, with a slight ridge toward the vertex. Antennæ of ♂ broadly bipectinated, 45 joints in male, the last 10 subfiliform, subplumose, the joints in the middle as long as they are thick, the distal pectinations as long and of the same size as the basal ones, with rather short and thick cilia; tip subfiliform; distal pectinations reduced to short teeth. Antennæ of ♀ with 40 joints, filiform, the vestigial basal pectinations reduced to very short minute teeth; those representing the distal pectinations very minute and short. Palpi rather large, reaching to the front; third joint distinct, longer than usual, not very thick, not so long as the second is broad. (Maxillæ not found after the removal of a palpus; no signs of maxillæ in specimens not denuded.) Thorax and body stout; the prothoracic collar well defined,

Fore wings slightly falcate; costal edge somewhat concave toward the apex; the latter obtuse; the outer edge slightly concave below the apex. Hind wings extending well beyond the tip of the abdomen. Legs stout, especially in the male, the fore tibia short and broad, being densely scaled; no tibial spurs. Fore tibia rather long, as long as in *Thyella*, densely hairy, concealing the sack, but with no spurs. The tibial odoriferous sack is large, about three-fourths as long as the tibia itself, broad, oval lanceolate, and ending in a sharp point; under it is a minute secondary sack, not so long as the outer one is wide. The legs with 5-jointed tibia, normal. Mr. Rothschild makes the strange statement that in *Nudaurelia* the fore tarsi [he says legs] are in the female "minute and entirely atrophied." He must have had imperfect specimens, as in my ♀ the tarsi are normal.

Venation: Vein II_2 wanting; vein II_1 arises as in *Lobobunaea* at the middle of the discal cell; in fact the venation of *Lobobunaea phaedusa* and *N. cytherea* are nearly identical, as may be seen in the figures, but *Nudaurelia* is more modified or specialized, as it has lost vein II_2, and the ocellus is a complete one. Hind wings [with] root or origin of veins II and III_1, much nearer together in *Lobobunaea* or *Bunaea*. III_2 more detached at base than in the other genera named.

Markings: Basal and extradiscal lines on wings of both pairs, and large completely formed ocelli on wings of each pair. The species have a superficial resemblance to those of *Antheraea*, a genus of Saturniidæ not occurring in Africa.

Geographical distribution.—Confined to the Ethiopian region or to Africa south of the Sahara and Egypt, ranging [southward] to Cape Town.

The genus so far as my scanty material indicates is recognizable by the broadly, stiffly bipectinate ♂ antennæ, those of the ♀ simple; by the broad acuminute tibial odoriferous sack, the long distinct third palpal joint, and the venation as above described.

Larva.—Head rounded, much as in *Gynanisa;* second thoracic segment with two large dorsal spines, twice as large as those (supraspicular ones) below, and bearing one or two spinules; those of the third segment of the same size as the dorsal abdominal ones; they are curved backward, and the dorsal ones are directed a little inwards. The median spine on eighth abdominal segment is wide, deeply cleft. On each abdominal segment is a group of from three to six irregular, flattened, ruffle-like bright yellow warts, while the body is velvety black. No prothoracic spines. Anal legs sphingiform. Suranal plate large, rounded triangular.

Confounded with those of *Antheraea* until the Hon. W. Rothschild separated a number of species from *Antheraea* under the present generic name. The species differ from those of *Antheraea* not only in venation, but in the subplumose antennæ of ♂ and the simple ♀ antennæ.

Under *Nudaurelia* Rothschild, page 43, enumerates 23 species, but of these we have referred the following to other genera: *N. arata, N. belina, N. menippe, N. zambesina, N. tyrrhea,* and *N. suraka.*

NUDAURELIA DIONE (Fabricius).

Plate XXXII, fig. 5; XXXVII, fig. 1; XLVII, fig. 3 (*antigone*).

Bombyx dione Fabricius, Ent. Syst., III, p. 410, No. 9, 1793.
"*Bombyx petiveri* Guérin, Bull. Soc. séricicole, p. 270, 1845."
Saturnia wahlbergii Boisduval, Delegorgue, Voyage Afrique Austr., II, p. 600, 1847.
Telea wahlbergii Herrich-Schaeffer, Sammlung Aussereur. Schmett., p. 10, I, fig. 95, 1854.
Antheraea dione Walker, Cat. Lep. Het. Br. Mus., V, p. 1244, 1855.
Antheraea gueinzii Staudinger, Stettin Ent. Zeitung, XXXIII, p. 120, 1872.
Antheraea simplicia Maassen and Weymer, Beiträge z. Schmett., 1st. Leif., fig. 20, 1872.
Antheraea wahlbergii Wallengren, Oefv. Vet. Akad. Forh., XXXII, (1) p. 97, 1876.
Antheraea dione Maassen and Weymer, Beiträge z. Schmett., 3e Leif., fig. 52, 1873.
Antheraea preussii Staudinger.
Anthereaea persephone Staudinger.
Antheraea antigone Staudinger.
Antheraea anthina Karsch, Berlin. Ent. Zeit., Pl. XIX, figs. 1, 2, 1892.
Nudaurelia wahlbergi Rothschild, Nov. Zool., II, p. 43, 1895.
Nudaurelia wahlbergi subsp. *anthina* Rothschild, Nov. Zool., p. 43, 1895.
Nudaurelia wahlbergi Rothschild subspecies *flavescens* Rothschild, Nov. Zool., p. 43, 1895.
Nudaurelia dione Sonthonnax, Annales Lab. d'Etude de la Soie, X, p. 17, Pl. VI, figs. 2, 3, 1900–1901.
Nudaurelia dione wahlbergi Sonthonnax, Annales Lab. d'Etude de la Soie, X, p. 19, Pl. VI, figs. 4, 5, 1900–1901.
Nudaurelia dione butleri Sonthonnax, Annales Lab. d'Etude de la Soie, X, p. 19, Pl. VII, fig. 1, 1901.
Nudaurelia dione emini Sonthonnax, Annales Lab. d'Etudes de la Soie, X, p. 19, Pl. VII, fig. 2, 1900–1901.
Nudaurelia dione gueinzii Sonthonnax, Annales Lab. d'Etude de la Soie, X, p. 20, Pl. VII, fig. 3, 1900–1901.

Imago.—Two ♂, one ♀. Head, thorax, and abdomen yellowish brown, in ♂ the thorax bright yellow ocher, but the head and collar reddish brown. Fore wings brown yellow or yellow bathed with pink; a diffuse scalloped basal line situated nearer the ocellus than the base of the wing. Extradiscal line straight, slightly scalloped, broad, diffuse and ending in the outer third of the costa, not much incurved. Ocellus oval cylindrical, longer than wide, inclosing a D-shaped space surrounded by yellow ocher, this by a sable-brown ring and the last by a broad grayish white ring.

Hind wings with the basal line faint or obsolete, the extradiscal sable brown shade lined on the inside with dull grayish, and either touching or situated a little way from the ocellus. The latter as in the fore wings, but circular and the central clear area is round, one-half as large as that on the fore wings.

Under side of the wings with an extradiscal line common to both wings. Ocellus of fore wings not so large as above, but the clear area is fully as large. On the hind wings the ocellus is nearly one-half smaller than above, the brown ring so much narrower, but the clear space is of the same size.

Expanse of fore wings ♂ 136 mm.; ♀ 124 mm.
Length of fore wing, ♂ 67 mm.; ♀ 58 mm.

Breadth of fore wing, ♂ 35 mm.; ♀ 32 mm.
Length of hind wing, ♂ 49 mm.; ♀ 43 mm.
Breadth of hind wing, ♂ 37 mm.; ♀ 35 mm.
Ocellus of fore wings, ♂ 12 by 8 mm.; beneath, 9 by 7 mm.; ♀ 12 by 7 mm.
Ocellus of hind wings, ♂ 17 by 13 mm.; beneath, 9 by 9 mm.; ♀ 14 by 11 mm.

This species varies in being sable-brown, the ♂ with a pinkish hue, or in being yellow, with a reddish brick-brown head and collar.

[The species being extremely variable, Dr. Packard made other descriptions which are given below.]

Geographical distribution.—Cape Town, South Africa. (Paris Museum.)

Imago.—Two ♂, one ♀. Front of head not so wide as in *N. cytherea*. Antennæ of ♂ subplumose, not quite so wide as in *N. cytherea*; ochraceous; the middle joints rather long; branches slender, well ciliated; tip subfiliform, consisting of five to six joints with vestigial branches, either shorter or no longer than the joints (in *N. cytherea* there are eight to nine joints and the branches are longer), ♀ antennæ simple, the vestigial pectinations unusually short and minute, like teeth. Palpi well developed, stout, wide, pointed, extending well beyond the front; the third joint not very distinct from the second.

Thorax rather stout, but not so much so as in *N. cytherea*, vestiture thick, shaggy, the clothing of the base of the wings denuded, shaggy, and that of the rest of the wings thick. Ground color of the wings and body ochreous yellow, varying from lemon-yellow (normal *dione*) to deep ochreous snuff-yellow (*preussi*) to dark reddish brown (*persephone*).

Fore wings decidedly falcate, considerably more so, and more pointed and produced at the apex than in *N. cytherea*, the outer edge being rather deeply excavated, much as in *N. rhodophila*. Half way between the base of the wings and the basal line is a distinct rather large diffuse whitish pink spot (gray in var. *persephone*). Basal line a broad diffuse lilac-brown shade externally whitish and expanding on the costa ; it is 4-scalloped, the scallops uneven, the largest one on the discal cell; the line is situated about half way between the ocellus and the insertion of the wing. Extradiscal line straight (not slightly sinuous as in *N. cytherea*), brown edged within with whitish and on the costa with a large whitish or hoary pink triangular costal patch. A submarginal broad lilac shade, divided into 7 points dusted over with reddish scales. Ocellus small (about one-fourth as large as in *N. cytherea*), oval (in a transverse sense) and inclosing an oval or subtriangular clear space outside of the discocellulars, and with a narrow ochreous, and an outer still narrower reddish brown ring; it is situated about half way between the extradiscal and basal lines.

Hind wings concolorous with those of the anterior pair, except the deep pink or roseate area along the costal edge, extending from the base to the extradiscal line and as far as the ocellus (not present in *N. cytherea*).

Basal line distinct (not so in *N. cytherea*), brown, edged externally with pink white and making a sharp angle on the fold (or obsolete vein V). Ocellus large and just touching the extradiscal line; middle ochreous yellow centered with a small round clear space; the yellow encircled with a rather narrow brown ring (about half as wide as in *N. cytherea*) and this by an outer broad white ring.

Under side of the wings as above but densely dusted over or bathed with gray lilac scales; ocellus smaller than above, and on the hind wings it is reduced to a small roundish, sometimes angular clear spot, the discal veins being distinct, beyond which is a small clear space. The submarginal 7-scalloped shade is distinct. (In *N. cytherea* there are no hoary lilac scales above or beneath.)

Expanse of fore wings, ♂ (*preusii* and *persephone*) 108–114 mm.
Length of one fore wing, ♂ 60–65 mm.
Breadth of one fore wing, ♂ 30–34 mm.
Length of hind wing, ♂ 42–48 mm.
Breadth of hind wing, ♂ 30–37 mm.
Ocellus of fore wings in *preusii*, 3½ by 4½ mm.

Ocellus of fore wings in *persephone*, 3 by 4 mm.
Ocellus of hind wings in *preusii*, 12 by 10 mm.
Ocellus of hind wings *persephone*, 14 by 11 mm.
Ocellus of under side of hind wings, 4 by 4 mm., in both varieties.

Normal *N. dione* ♀, from Sierra Leone (Schaus collection). One ♀. Head not so broad as in *N. cytherea*, body and wings lemon-yellow, tibiæ and tarsi brown; thorax in front deeper ochreous. Antennæ nearly simple, the distal vestiges about one-half as large and long as the basal, the latter not so large and long as in *N. cytherea* and the antennæ rather more simple and slenderer than in that species.

Fore wings a little more produced toward the apex; the hind wings with the outer edge not so full and rounded; the apex and inner angle more rectangular than in *N. cytherea*. The wings are lemon-yellow; a basal reddish discoloration; basal line purplish brown, deeply zigzag, with three large scallops Extradiscal line not scalloped, brown, not edged with white on the inside. An obscure submarginal reddish shade. Ocellus round (7 by 7 mm.) with a subtriangular clear center encircled by a much narrower ochreous ring than in *N. cytherea*, succeeded by a brown circle, than a pale lilac, and an outermost brick red circle.

Hind wings lemon-yellow; a basal dusky lilac zigzag shade, and extradiscal line brown, excurved and touching the outer limit of the round ocellus, which is larger (10 by 9½ mm.) than on the fore wings, but with a smaller central clear spot, and a wider outer circle than on the fore wings. The ocelli differ from those of *N. cytherea* in being roundish instead of oval, and in the narrower ochreous circle and in the outer circle being lilac red.

Under side of the wings: Those of the anterior pair with no basal line; ocelli nearly as above, but those of the hind wings smaller and less distinct. The wings are thickly dusted with lilac, and on the hind wings is a submarginal broad zigzag lilac shade.

Expanse of fore wings, ♀ 113 mm.
Length of a fore wing, ♀ 62 mm.
Breadth of a fore wing, ♀ 34 mm.
Length of a hind wing, ♀ 40 mm.
Breadth of a hind wing, ♀ 29 mm.

My ♀ agrees with Sonthonnax's figure of *N. dione*, except that the basal lines on both wings are more distinct, and the ocelli are all rounder than in his figures.

As stated by Sonthonnax, who has materially reduced the number of nominal species to synonyms of *N. dione*, this species is "extremely polymorphous and polychromatic." We do not yet know enough about the local variations to state what are such. My ♂ *N. preussii* is certainly the same as *N. wahlbergii* in the Schaus collection, and as figured by Herrich-Schaeffer. *N. persephone* is only a dark reddish variety of *wahlbergii*. *N. butleri* is a bright yellow form without brown scales. The ocellus of the hind wings "is quite large, yellow in the center, bordered with black, red and rose" (Sonthonnax). *N. emini* has the middle zone of the fore wings reddish brown, the rose color disappears on the basal line, the ocellus of the fore wings is rounded lunate, while that of the hind wings is very large, oval, yellow in the middle and inclosing a small lunate clear spot, beyond are black, red, and an outer rose circle. *N. gueinzi* is plainly only a variation, yellowish rust-red brown, without the submarginal scalloped shade in either pair of wings; the ocellus of the fore wings is small; that of the hind wings large; the yellow center encircled by only two rings, a blackish one and another roseate one, with no trace of the red ring present in *N. emini*.

Geographical distribution.—The species ranges over equatorial and southern Africa, from the western to the eastern coast, while *N. cytherea* is confined to Cape Colony; it is most commonly met with from Sierra Leone to the Congo region; it is quoted from Madagascar, Ashanti, Congo, and Port Natal (Walker in Brit. Mus.); the Madagascar example is pale fawn color. *N.* var. *wahlbergii* is from Lake Tanganika (Oberthür); var. *emini* from [Central Africa]; var. *gueinzii* from Port Natal (Walker); var. *persephone* from Camerons (Neumoegen coll. in Brooklyn Museum).

Larva.—An alcoholic specimen, well preserved, from Sierra Leone, West Africa, presented to the American Museum of Natural History, New York, by Mr. William Schaus. Length, 45 mm. (This is evidently in the stage before the last, as the two *wahlbergi* are nearly twice as large.)

Head rather large, rounded, black, with irregularly but densely scattered fine papillæ, in groups of about 3 to 10; none on the clypeus or about the mouth parts, jaws, etc. Body black-brown armed with large, stout sharp spines. Prothoracic collar large, unarmed, shining black. Below it, directly in front of the spiracle, is a low flattened tubercle, the surface polished and bearing four to five setiferous papillæ. Farther down over the base of the prothoracic legs is a higher tubercle, but still not so high as broad, and bearing four to five slender setæ.

The spines are as usual in eight rows, the dorsal ones of the basal and middle abdominal segments as large as the thoracic ones. They are all large, deep honey-yellow in color, very sharp, curved backwards, and bear from four to six long slender pale setæ, arising from prominent papillæ.

The median spine on the eighth abdominal segment with a distinct impressed line behind, and distinctly double at base, deeply forked for one-third of its entire length, i. e., on its distal third.

The spines of the lowest row are deep honey-yellow like the others, and are low, conical, with the surface polished, except two on the ninth abdominal segment, situated directly in front of the anal legs, which are more acute and longer.

Suranal plate large, shining black, the edge somewhat thickened, regularly rounded behind; the surface not armed with tubercles or vestiges of them. Anal legs large, triangular, black. Thoracic legs and middle abdominal legs black.

This has the generic characters of the larval *Cyrtogone*, whose imago is so much more specialized. It differs in having no white flattened minute tubercles. The median eighth abdominal spine is forked in the same way and fully as deeply divided, in fact a little more so.

NUDAURELIA WAHLBERGII (Boisduval).

Plate XXXII, fig. 4; XLVII, fig. 2 (*N. anthina*); CVI, figs. a–c.

[See synonymy under *N. dione*. Rothschild (1895) treated *N. wahlbergii* as a distinct species, with *anthina* (Karsch) and *flavescens* Rothschild (from Accra) as subspecies. Dr. Packard's latest opinion was that *wahlbergii* should be placed under *dione*, but the account given below is left as originally written.]

Saturnia wahlbergii Westwood.

Antherea dione, var. *wahlbergii* Herrich-Schaeffer, Samml. Aussereur, Schmett., p. 61, fig. 95, 1854.

Judging from Herrich-Schaeffer's figure this species differs from *A. cytherea* by the wings being more ochreous, the discal ocelli being round, not encircled with white, while the extradiscal line is more decidedly scalloped, otherwise it may prove to be a climatic variety of *N. cytherea*. It is certainly a very nearly allied species.

Larva.—Length 80 mm. Head and body black, like *N. dione* in all important respects, i. e., in the shape of the body and length of the spines. Prothoracic collar and its armature as in *N. dione*. Dorsal spines of the same shape and length from the second thoracic to the eighth abdominal segment; those of the second thoracic segment darker than the others, which are bright reddish copal or honey-yellow; the spines of the infraspiracular and lower row of the second and third thoracic segments are black, while those of the infraspiracular series on abdominal segments 1 to 8 are reddish, and the area around the base is reddish.

Compared with *N. dione* from Sierra Leone the surface of the head is a little more densely granulated, and the suranal plate is rougher on the surface and is submucronate at the end, instead of being well rounded. Anal legs the same in the two forms. Around the base of the spines the skin is reddish, or with a yellowish red tinge. The median spine on the sixth abdominal segment rises from a transverse low reddish ridge, at each end of which is situated the supraspiracular spine. The spines each bear from four to six long white sharp spines, the points of which are sometimes slightly dark.

The distinctive mark of *N. wahlbergii* is the two dorsal groups of bright yellow fungoid warts, four or five to eight or nine in a group, and of irregular oval or polygonal shape; between the dorsal and supraspiracular spines on abdominal segments 1 to 7 the spots are largest on segments 4 to 6; on the eighth segment there are only one or two on one side.

The median "horn" or tubercle is just as in *N. dione*, being split down or forked in the same manner. Two examples from Durban, March, 1901. J. M. Fawcett.

NUDAURELIA RHODOPHILA (Walker).

Antherea rhodophila Walker, Proc. Nat. Hist. Soc. Glasgow, I, p. 343, 1869.
Antherea intermiscens Walker, Proc. Nat. Hist. Soc. Glasgow, I, p. 344, 1869.
Gonimbrasia rhodophila Kirby, Syn. Cat. Lep. Het., I, p. 753, 1892.
Gonimbrasia intermiscens Kirby, Syn. Cat. Lep. Het., I, p. 753, 1892.
Gonimbrasia rhodophila Rothschild, Nov. Zool., II, p. 39, 1895.
Gonimbrasia intermiscens Rothschild, Nov. Zool., II, p. 39, 1895.
Bunaea intermiscens Sonthonnax, Annales Lab. d'Etude de la Soie, X, p. 28, Pl. XV, fig. 1, 1901.

Imago.—One ♂. Head as usual in *Nudaurelia*; front broad, square toward the labial region; surface full, convex. No trace of tongue. Antennæ of ♂ dark, almost black, subplumose, bepectinate, 16 double sets of branches, tip subfiliform, the nine terminal joints with seven to eight pairs of rather long vestigial branches. Palpi stout, reaching the front, but not passing beyond it; third joint small, distinct, not so long as the second joint is broad. Thorax with the vestiture moderately shaggy; greenish yellow with whitish roseate hairs.

Fore wings falcate, of the same shape, but a little less acute at the apex than in *N. anthina;* wings of both pairs yellowish olive green with hoary lilac shades. Basal line narrow, dark, differing from that of *N. anthina* in being straight instead of zigzag, with a slight bend or dislocation on the median vein; beyond this a broad lilac hoary shade, expanding along the third median vein (IV_2), and again toward the discal spot. Extradiscal line as in *N. anthina,* a double narrow dark line mixed with yellow, whitish between the two lines; costal end of line toothed [?] on both sides and to the apex with hoary lilac. Beyond is a pale lilac broad shade extending externally (as in *N. anthina,* but more distinctly); seven sharp triangular points or scallops. Discal clear spot small triangular, with no ring or aureole around it.

Hind wings concolorous with the fore wings; the basal white band bent toward the inner edge of the wing as in *N. anthina,* and shaded in the middle with brown both inside of the white line, and outside between it and the discal ocellus. Extradiscal line white, curved outward as in *N. anthina,* shaded externally toward the costal edge with brown and also inside toward the ocellus; beyond is a zigzag line of five or six pale lilac scallops. Discal ocellus large, almost perfectly round (13 x 12 mm.); a clear central round space inclosed by a deep ochreous ring, then a dark brown ring not so wide as in *N. anthina,* and outside is a pale tawny ring edged toward the costal side with white. Costal region as far as the discal spot, deep reddish salmon.

Wings beneath hoary gray, especially those of the hinder pair; the discal clear spot on the fore wings as above, but no ocellus or any spot on the hind wings. Extradiscal line common to both wings, but fainter than above. A submarginal series of about eight hoary lilac points as above. Edge of both wings greenish yellow.

Expanse of fore wings, ♂ 110 mm.
Length of fore wing, ♂ 59 mm.
Breadth of fore wing, ♂ 30 mm.
Length of hind wing, ♂ 37 mm.
Breadth of hind wing, ♂ 29 mm.

Differs from *N. anthina* in its olive-yellow green hue, in the basal line being straight, not zigzag, in the reduced discal spot, having no yellow ring around it, and in having no discal spot on the under side of the hind wings, when in *N. anthina* one is present on each wing.

It agrees with Sonthonnax's figure (from a photograph) of "*B. intermiscens.*" The original type of *intermiscens* is in the Strecker collection, as I was told by Mr. Strecker himself.

Mr. Rothschild states that Walker's *B. intermiscens* is a synonym of his *B. rhodophila.* My specimen is in the Schaus collection in the American Museum of Natural History.

Geographical distribution.—Congo, Cameroons, West Africa (Sonthonnax), Calabar.

NUDAURELIA JAMESONI (Druce).

Plate XXXVII, fig. 2.

Bunaea jamesoni Druce, Jameson's Story of the Rear Column, p. 448, 1890.
Gonimbrasia rubricostalis Kirby, Ann. and Mag. Nat. Hist., X, p. 174, Pl. XI, fig. 2.
Bunaea staudingeri Aurivillius.
Bunaea jamesoni Rothschild, Nov. Zool., II, p. 39, 1895.
Bunaea jamesoni Sonthonnax, Annales Lab. d'Etudes de la Soie, p. 30, Pl. XIII, fig. 2, 1900–1901.

Imago.—One ♂, one ♀. Antennæ of ♂ well pectinated, only slightly subplumose, with 27 to 28 joints, and the branches well ciliated; the tip subfiliform, consisting of 10 joints, the external vestigial branches of the tip longer than the inner, and well developed, and about as long as the joints themselves. Antennæ wanting in my ♀. Head fairly prominent; the front not very convex, only moderately wide; the vestiture close. Palpi large, stout, porrect, well developed, and extending a little beyond the front; third joint fairly well developed, unusually distinct from the second.

Body and wings Vandyke brown; collar and tegulæ faintly edged with whitish scales.

Fore wings distinctly falcate; the costa much arched and the apex unusually sharp in ♂, more so than in *N. dione;* outer edge deeply and regularly excavated; inner angle well rounded. Hind wings with the costa very convex, apex squarish; outer edge moderately convex. Abdomen not reaching to the inner angle or very near it. Wings of both pairs uniformly pale rich Vandyke brown. Fore wings with the basal line faint, obsolete. Extradiscal line straight, not sinuous or scalloped, arising from the outer third of the inner edge and ending on the costa before the apex in a hoary cloud; the line is blackish, edged within with whitish. Discal spot small, subtriangular or D shaped, the outer side rounded, surrounded by a faint dark line, not forming a distinct circle. Hind wings like the fore wings, but with a roseate shade on the costal region, which does not reach the apex; extradiscal line dark, diffuse, whitish within, curved outward and nearly touching the discal spot, which is large, black-brown, with a small round clear area in the center, encircled with snuff brown; while the outer circle is very pale Vandyke brown, paler than the rest of the wing; the basal line in ♀ white, distinct, more so than in the ♂.

Fore wings beneath as above, but more hoary along the extradiscal line; along the inner edge roseate. Hind wings with the ocellus only a clear spot, smaller than on the fore wings. Extradiscal shade faint, slightly marked, not curved, not roseate beneath. The ♀ only differs in having a diffuse broad hoary shade beyond the extradiscal line above and beneath.

Expanse of fore wings, ♂ 95 mm.; ♀ 122 mm.
Length of a fore wing, ♂ 50 mm.; ♀ 70 mm.
Breadth of a fore wing, ♂ 25 mm.; ♀ 38 mm.
Length of a hind wing, ♂ 32 mm.; ♀ 48 mm.
Breadth of a hind wing, ♂ 25 mm.; ♀ 33 mm.

That this species is not a *Bunaea,* to which it has been referred by Druce, Aurivillius, Rothschild, and Southonnax, but a true *Nudaurelia,* is shown by the venation, which is almost exactly as in *N. dione* and *rhodophila,* as may be seen on reference to Plate XXXVII, Figures 1 and 2. Veins II_1 and II_2 and II_3 are well developed and the origin of the median branches are almost identical. The unusually falcate ♂ wings, the pointed apex, the small triangular clear discal spot, without an aureole around it, give it an appearance, not so much like *Bunaea,* as we have restricted that genus, as of a species of *Lobobunaea* or *Gonimbrasia.*

Geographical distribution.—West Africa, Sierra Leone (Schaus collection, Amer. Mus. Natural History, New York).

NUDAURELIA AURANTIACA Rothschild.

Nudaurelia aurantiaca Rothschild, Nov. Zool., II, p. 42, 1895.

Imago.—"Fore wings deep ruddy orange; about one-third from the base they are crossed transversely by a double zigzag line from the costa to the inner margin; on the inner side this double band is black, and in the outer white. At the apex of the cell there is an ocellus surrounded by a black outer ring, center vitreous with a broad fuscous inner ring. A little beyond

the ocellus the wings are crossed by a second double transverse band from the costa to the inner margin, but this band is white on the inner side and black on the outer.

"Hind wings similar to the fore wings, but without the transverse band at the base. Ocellus very large, and outside the black ring are three more; first a crimson one, then a pink ring, and lastly an outside crimson one. Thorax and abdomen deep rufous chestnut. Underside similar to the upper side, but the basal transverse band is absent in both fore and hind wings.

"Expanse 5 inches=127 mm.

"*Habitat.*—Longive Valley, Lake Nyassa."

NUDAURELIA CYTHEREA (Fabricius).

Plates XXXII, fig. 3; XXXVII, fig. 3.

Makes no cocoon. Pupa naked, the abdomen ending in a large [bifid] spine, like *Eacles*

CREMASTOCHRYSALLIS Karsch.

Plate CXIII, fig. 1.

Saturnia WESTWOOD, Proc. Zool. Soc. London, 1881.
Cremastochrysallis KARSH [Berlin Ent. Zeitzchr., XXXVII (1893), p. 499].
Cremastochrysallis ROTHSCHILD, Novitates Zoologicæ, II, p. 38, 1895.
Pseudoantheraea STAUDINGER.

Imago.— ♀. Head fairly prominent; front a little narrower than usual; the vestiture closely cropped, coming to a point in front, and not concealing the palpi.

Antennæ of ♂ with pectinations of moderate width, tip filiform. Those of the ♀ with short joints, not quite so long as wide; one pair of pectinations to a joint; no traces of a distal pair; the pectinations about four times as long as the joint itself. Palpi short, small, weak, depressed, not reaching near the front; composed of but a single joint, which when denuded is seen to be only about three times as long as thick; the terminal scale scraggly, unequal. (Besides these there is a distinct tuft of scales on each side of the mouth, and below the orbito-lateral foramina, which are open and distinct, being situated near the site of the atrophied maxillæ of which there are no traces.)

Thorax and body moderately stout; vestiture moderately abundant and long. Fore wings large, triangular; costa moderately arched; apex somewhat rectangular; the wings not falcate in either sex; outer edge moderately full, not excavated, about equal in length to the inner edge. Hind wings with the apex moderately rounded; outer edge moderately full, only slightly convex; inner angle almost rectangular; inner edge very long and straight, and reaching far beyond the end of the abdomen.

Venation: Approaching that of *Nudaurelia* and *Lobobunaea;* the origin of the first sub-costal vein (vein II_1) situated in front of the middle of the discal cell, and just before the origin of the common stalk of vein II_3 and II_4 ; vein II_2 minute, vestigial, forming a slight tooth-like projection, not reaching near the costa; vein III_3 detached and partly independent, more detached than in *Nudaurelia* or *Lobobunaea*. Discocellular veins collectively forming a straight line, much as in *Nudaurelia* and *Lobobunaea*, but not even slightly curved.

Hind wings much as in the genera mentioned.[1]

Markings: Ground color of body and wings dull snuff-yellow, with dull brick-red lines and shades, clear moderately large discal somewhat lunate spots on each pair of wings, but they are not encircled by bright shiny lines, only a single dark reddish ring.

Larva.—Not known.

Pupa.—Dr. Holland has figured the pupa, and has stated "the fact that the chrysalis is suspended, and while the caterpillar weaves a few stout silken threads about the spot where it undergoes its transformations, the chrysalis hangs pendulous from its support like the chrysalis of the Nymphalidæ."

[1] An interesting peculiarity in my single specimen is that the basal portion of the vestige of vein III, in the discal cell, is thick and like the bases of the other veins; this seems to be a case of survival of a portion of this vein, which in the Paleolepidoptera (*Micropteryx*) and the generalized Neolepidoptera (Hepialidæ) forms a true well-developed vein, dividing the discal cell into two divisions.

The notable features, judging by Holland's figure, are the spinous cremaster by which the pupa is suspended head down, the hooks of the cremaster grappling in a loose pad of silk; the large spines on the abdominal segments; and those on the head and back of the thorax.

Geographical distribution.—Western Ethiopian realm, Old Calabar, and the French Congo, about the mouth of Ogové River, a little south of Cape Lopez.

CREMASTOCHRYSALLIS ARNOBIA (Westwood).

Plate XXXVI, fig. 1.

Saturnia arnobia Westwood, Proc. Zool. Soc. London, January, 1881, p. 142, Pl. XII, fig. 2.
Cremastochrysallis arnobia Karsch.
Pseudoantheraea arnobia Staudinger.
Saturnia arnobia Holland, Psyche, VI, No. 190, p. 213; Pupa, Pl. 5, fig. 1, February, 1892.
Copaxa (?) *arnobia* Kirby, Syn. Cat. Lep. Het., I, p. 755, 934, 1892.

Imago.—One ♀, in poor condition (torn but not rubbed). Head, body and wings snuff-yellow ochre, with dull brick-reddish markings and shades, the wings thickly dusted with dull reddish scales.

Fore wings uniformly dull ochreous yellow, thickly dusted with reddish brown, and crossed by four broad shades or diffuse bands. The basal line is a little nearer the discal spot than to the insertion of the wing; it is broad, diffuse, broken on the vein and between that and the inner edge is incurved. Between this and the discal spot is a broad dark red shade slightly incurved, and on the inner edge uniting with the extradiscal shade, which is nearly straight, and ends on the costa before the apex; no marginal shade or blotches. Discal spot large, clear, surrounded by a dark ring, as figured by Westwood.

Hind wings more yellow, especially toward the base than the fore wings. A basal shade just within the discal spot; just beyond it a broad scalloped line of 7½ scallops, red brown in hue, then a yellowish shade; the margin densely powdered with rust-brown scales. Discal spot a large clear rounded lunate space, a little excavated on the inside, and encircled with a broad dark reddish-brown roundish oval ring.

Under side of the wings more yellowish than above, especially those of the hinder pair, but the shades are as above, though broader, more diffuse, and less distinct. Discal spot with the clear portion larger than above, more distinctly lunate, and showing a part of the discal vein. On the fore wings the discal spot is as above.

Expanse of the fore wings, ♀ 140 mm
Length of a fore wing, ♀ 76 mm.
Breadth of a fore wing, ♀ 40 mm.
Length of a hind wing, ♀ 51 mm.
Breadth of a hind wing, ♀ 42 mm.
Ocellus of fore wings, 9 by 6 mm.; of hind wings, 9 by 8 mm.

[Rothschild recognizes an ab. *discrepans* (Butler).]

Pupa.—Mr. Good described the chrysalis as "dark green in color, beginning to change before disclosing the moth, to a pale green, and later to the yellow of the empty shell."

The rainy and dry season broods have been thus described by Dr. Holland:

"Mr. Good sent me of this brood six perfect specimens, male and female, and several chrysalids which had failed to disclose the imago, and from one of which the figure on Plate 5 is drawn. Later he sent me three of the second brood, and a chrysalid, which in form is identical with the chrysalids of the first brood, but smaller. This last sending was accompanied by the following note:

"'No. 43: I designate these specimens by the same mark, No. 43, as those which I sent you in the summer. The chrysalid appears to be identical in form and color, but the moths are very different in color. If this is the same species, then the larvæ bred in the dry season do not produce as fine moths as those that feed in the latter part of the rainy season. These specimens emerged October 15, 1888, the rainy season, which is late this year, having just commenced.'

"Rainy season brood: ♂. Not differing materially from the figure and description of Prof. Westwood. The ground color is a bright yellow, with the darker markings ochraceous rufous. Expanse 6½ inches.

"♀. Wings very broad, and not nearly as pointed at apex as in the male. General color tawny ochraceous, with darker markings deep burnt sienna. Expanse of wings 7–7¼ inches.

"Dry season brood: The general color of the two sexes is the same, and may be described as mars brown, with the darker markings of a livid purplish cast.

"Expanse of wings: ♂ 4¾ inches; ♀ 5–5½ inches."

Geographical distribution.—Old Calabar, West Africa, near mouth of the Niger River, and most of Cameroom; lat. 11° 50′N. (Westwood); Elove, a town 15 miles down the Ogove River from Kangwé, French Congo, a little south of Cape Lopez (Holland).

GYNANISA Walker.

Gynanisa Walker, Cat. Lep. Het. Br. Mus., VI, p. 1267, 1855.
Gynanisa Kirby, Syn. Cat. Lep. Het., I [p. 763].

[The type of the genus is *G. maia.*]

Imago.— ♂ and ♀. Head when denuded seen to be broadly triangular, nearly twice as wide on the vertex as in the labial region; rather broad and square in front. Male antennæ broadly pectinated, plumose, tip (broken off in specimen examined), joints shorter than thick; pectinations of both pairs equally long, slender and clothed with long dense cilia; those of ♀ simple, denticulate, flattened; distal pectinations minute, forming very short teeth. Palpi stout, broad, and long, extending well beyond the front; third joint fairly distinct, slender, not so long as second is broad. Thorax and abdomen stout; the prothoracic collar fairly distinct.

Fore wings of ♂ rather broad, not falcate, costa somewhat curved toward the apex, the outer edge neither excurved, nor convex; apex not acute. Hind wings somewhat produced toward the apex; outer edge of the wings slightly scalloped. Hind wings extending a little beyond the end of the abdomen.

Venation: Vein II_1 [III_1 is revised nomenclature] arising a little beyond the middle of the discal cell, II_2 is present. The common stalk of vein II_2 and II_3 and II_4 also arises at the outer fourth of the discal cell far within the discal veins; the two latter in fore and hind wings form a sinuous line, neither curving outwards, as in *Thyella* or *Salassa*, but more as in *Nudaurelia cytherea*, and these veins are nearer the base of the wing than in *Nudaurelia*; vein III_2 is less detached from III_1 than in *Nudaurelia*. Hind wings much as in *Nudaurelia*, but discal cell is shorter.

Markings: Ground color dark fawn brown; fore wings crossed by five lines, the two outer indistinct; an incomplete small triangular black ocellus on the fore wings, containing a large oblong or subtriangular clear spot. Hind wings with a very large ocellus as in *Bunaea*. Legs very thick and densely hairy; fore tibia (when denuded) short, moderately stout, and ending in two unequal spines; odoriferous sack very large, nearly as long as the tibia itself, lanceolate, oval, acuminate, the tip sharp, polished, and from it on the outside extends a polished ridge to the base. Two long unequal spines on third pair of legs.

Genitalia: The suranal plate narrow, forked at the end, or rather with a deep sinus; a simple pair of claspers, from side view broadly triangular, and from above and beneath long, narrow, and acute; penis acutely triangular. Genitalia are of the same general type as in *Thyella* and *Acanthocampa.*

Larva.—[Packard, Psyche, IX (1901), p. 281.] Body thick, armed with singular smooth sharp spines, which are appressed, grown to the skin, only the rounded or sharp ends rising up and directed inwards and backwards. The head is unarmed, but on the clypeus anteriorly is a low conical tubercle (a feature we have never observed in any American or European larva). Spines smooth, not bearing any setæ. Near the spiracles are situated groups of crateriform warts. The median spine on the eighth abdominal segment is forked. The suranal plate is subtriangular, with the apex much rounded; and the surface tuberculated; anal legs large, triangular.

The larva is a very remarkable one from the nature of the stout spines, and the forked median spine on the eighth abdominal segment is a noteworthy feature.

A genus differing from *Bunaea* in the longer, larger palpi, the nonfalcate, scalloped fore wings, and the stouter body. The ♂ antennæ are narrower, with shorter teeth. In its venation and shape of the discal cell it is closely similar to that of *Nudaurelia* (*N. cytherea*), and is also intermediate between that genus and the Asiatic *Salassa*. In the small clear hemispherical discal spot of the fore wings it approaches *Salassa*.

Geographical distribution.—South Africa; Port Natal, Maritzburg, Natal, October 25, 1900. (Quekett.)

GYNANISA MAIA (Klug).

Plate XXXVI, fig. 4; CIX, fig. a–c (*isis*).

Saturnia maia Klug, Neue Schmett., t. 5, fig. 1, 1836.
Saturnia isis Westwood, in Duncan's Naturalists' Library, Exotic Moths, XXXII, p. 138, pl. 13, 1841.
Gynanisa isis Walker, Cat. Lep. Het. Br. Mus., VI, p. 1267, 1855.
[*Gynanisa maia*] Kirby, Syn. Cat. Lep. Het., I [p. 763].
[*Gynanisa*] *isis* Rothschild, Nov. Zool., II, p. 45, 1895.
[*Gynanisa*] *maia* Rothschild, Nov. Zool., II, p. 45, 1895.

Imago.—One ♂, two ♀. Head and thorax Vandyke or chestnut brown; two white bands behind the head, the second one, forming the hinder edge of the collar, the widest one of the two. Fore wings grizzly chestnut brown, darker on the outer edge, crossed by four distinct dark-brown lines, and a fifth less distinct. Basal line formed of two long scallops, being blackish edged externally with grayish white, the black widening on the costa, the white toward the discal spot. The second line is scalloped and either (a small ♀ from Amer. Mus. Nat. Hist.) interrupted by the discal spot, or (in the ♂) is situated just beyond it, sending a loop or scallop into it, or in the large Durban ♀ (like the one figured in Naturalists' Library) the line is farther out from the spot. A second parallel similar line is incurved near the inner edge on vein VII; both lines widen on the costal and inner edges; beyond are two faint diffuse shades. The discal spot on the fore wings is small, forming an incomplete ring, heavily black on the inside, then pink; the outer side black where the extradiscal line touches the spot, otherwise it (the Durban ♀) is not dark, the outer side of the subtriangular clear spot having no border. In the small ♀, however, the irregular oblong clear spot is almost entirely surrounded by a pinkish oval circle. Outer edge of both wings slightly scalloped, the interspaces grayish.

Hind wings more scalloped in ♀ than in ♂, base and outer edge as in the fore wings, but a large part of the wing is occupied by the very large ocellus, in which, however, the extradiscal line does not enter. The spot is mostly bright pink, and the basal line is pink. The center of the spot is black, inclosing a half-round O or lunate partly clear spot, a portion obscured by dark-brown scales, so that the outline is more or less distinct. This black center is encircled by a snuff-brown ring, this by a black ring, which is encircled by a very broad raw sienna ring, which is surrounded by a broad pink (small ♀) or a brick-red (♂), or dark blood-red ring (Durban ♀), beyond which is the dark-brown much-curved extradiscal line.

Under side of both wings hoary gray, checkered with brown on the costa and brown on the outer margin. The middle and extradiscal lines distinct. The discal spot interrupts the extradiscal line, the clear space as above, but the inner brown side is wider and more distinct. On the hind wings the discal spot is represented by the brown center and the umber-brown and the outer narrow dark brown line alone. No pink scales (small ♀); in the Durban ♀ the umber line is yellowish, so also in ♂.

Expanse of fore wings, ♂ 140 mm.; ♀ 100–140 mm.
Length of fore wings, ♂ 65 mm.; ♀ 54–66 mm.
Breadth of fore wings, ♂ 33 mm.; ♀ 28–37 mm.
Length of hind wings, ♂ 48 mm.; ♀ 35–47 mm.
Breadth of hind wings, ♂ 35 mm.; ♀ 30–35 mm.
Ocellus of fore wing, ♂ 4 x 4; beneath (?), 6 x 4.
Ocellus of hind wing, ♂ 26 x 26; ♀ 18–25 x 15–23 mm.

It seems probable that *G. maia* and *isis* are synonyms, as both species occur in the same region. Rothschild states that *G. isis* is only a color aberration of *G. maia*. My large ♀ agrees well with Westwood's figure in the Naturalists' Library. It is from among the duplicates received from the British Museum, and agrees with the specimen labeled *G. westwoodi* Rothschild.

The type of *G. isis* is in the Dublin Museum, and that species does not occur in the British Museum. [A later penciled note states that the type of *G. isis* is in the Oxford Museum, and from it the following notes were made.] The same as I have; four heavy black lines cross fore wing; no true ocellus [on fore wing], but a small oval discal spot, edged within with black; large ocellus on hind wing, black center, brown ring, then a black ring, inclosed by a brown, and outermost pink broad ring over half an inch across.

Geographical distribution.—Port Natal, Cape, South Africa (Walker in British Museum).

Larva.—(*Gynanisa isis*). Body cylindrical, thick, a large thick spiny caterpillar. Head about one-half as thick as the body; surface unarmed, with short minute wrinkles or corrugations; pale olive green; a short black line on each side of the clypeus, the anterior division of which bears a low conical tubercle, situated each side of a median smooth ridge.

Prothoracic shield distinct, of the usual lunate shape, unarmed, the surface nearly smooth, only slightly corrugated, and the front edge shining jet black; on the side of the segment directly in front of the spiracle is a low thick tubercle, and lower down a few simple flattened pale warts.

Second and third thoracic segments each with two dorsal tubercles, not erect but flattened and adhering to the skin on the basal two-thirds, they are pointed inward toward each other, with the ends erect, but rounded, not ending in a spine; those of the third are a little larger than those on the second segment. A supraspiracular and an infraspiracular smaller minute tubercle, a continuation of the three rows of similar tubercles on the sides of the abdominal segments. These two segments are crossed by three irregular rows of irregular flattened pale tubercles.

On abdominal segments 1 to 7 are six rows of large tubercles (three on each side of the body) inclined inward and backward toward the median line of the body, and larger than those on the thoracic segments, each ending in a stout sharp point. The two dorsal spines of each segment are tipped with black, the small lateral ones not thus tipped. These spines are all smooth and bear no setæ. In the neighborhood of and behind each spiracle is an irregular group of five to six elongated oval crateriform warts, and two between the dorsal spines on the first three abdominal segments.

On the eighth abdominal segment is a single median stout short spine, not so long as those in front, but deeply cleft or forked at the end, each fork acute and diverging from its mate. Around the base of the spine are about 16 pale flattened circular smooth warts.

Suranal plate subtriangular, apex much rounded, with about a dozen solid thick black tubercles, each giving rise to a short minute seta; they are mostly collected around the end of the plate. A lateral reddish line. Thoracic legs stout, pale, black at the sutures between the joints. Abdominal legs reddish below, dark on the planta. Under side of the body speckled with fine oval setiferous pale warts. Anal legs large, their sides triangular in shape, bright yellow, the lower edge or plantar region shining jet black. Spiracles pale sienna brown.

Length 77 mm., thickness 15 mm.

Described from a blown specimen from Natal received from Staudinger and Bang-Haas.

GYNANISA WESTWOODI Rothschild.

Plate CIX, fig. d.

Gynanisa westwoodi Rothschild, Nov. Zool., II, p. 45, 1895.

Imago.—Differs from *G. maia* (Klug) by its extremely falcated fore wings and dingy color.

"Fore wings much narrowed toward the apex and strongly curved or sickle-shaped, brownish buff powdered with black and gray scales on the basal half; the transverse line nearest the base is elbowed, but not zigzag as in *maia* (Klug). Ocellus diamond-shaped, thus with a

small vitreous dot near the apex, while in *maia* (Klug) the ocellus is ovate and with a large vitreous center. The second transverse black band crossing the fore wings is contiguous to the ocellus and quite straight, while in *maia* (Klug) it is zigzag and well away and separate from the ocellus. The third transverse band is reduced to an almost obliterated hair-like black line, while in *maia* (Klug) it is a well-developed double black and white band. Beyond this third transverse band in *westwoodi* there is a very broad pale buff band three-quarters of an inch wide, while in *maia* (Klug) it is barely half so wide and orange buff powdered with black and having a broad chocolate bar running down the center. Outer margin drab-gray instead of black brown as in *G. maia* (Klug).

"Hind wings; these show the same differences from those of *G. maia* (Klug) as do the fore wings, while the pupil of the ocellus is black and twice as large as in *G. maia* Klug."

"Expanse 6 inches = 153 mm."

Geographical distribution.—"Taveta, East Africa."

GYNANISA ETHRA (Westwood).

The male has a short tail, and must represent another genus.

Rothschild reports *G. ethra* from Maube, W. Africa.

[Sonthonnax (1903) has described other species as *G. albescens*, *G. semialba*, and *G. yigas*.]

LOBOBUNAEA Packard.

Bunaea Hubner [(in part.)]
Bunaea Rothschild, Novitates Zoologicæ, II, 1886.
Bunaea Kirby, Syn. Cat. Lep. Het., I, p. 751, 1892.
Lobobunaea Packard, Journ. N. Y. Ent. Soc., IX, p. 191, Dec. 1901.

Imago.—Head wider than in *Bunaea*. Antennæ not so wide as in *Bunaea*, and the end is subfiliform, with very short pectinations for a distance nearly equal to width of the entire antenna; joints short and thick, two pairs of pectinations to a joint, and those of the distal pair are as long as the basal ones. Palpi larger and longer than in *Bunaea* and the third joint reaches to the front, passing slightly beyond it. Thorax with a definite collar, the prothoracic squamation being more distinct than usual. Forelegs long and stout, tibia of ♂ with a naked, probably odoriferous, sack, like that present in certain Deltoid moths, on the under side two-thirds as long as the tibia itself, and the scales separate from it, leaving it naked and easily seen from beneath. Fore wings large and broad, costa straight on the basal half, but beyond much curved, so that the wing is falcate; outer edge more deeply excavated than in *Bunaea*. Hind wings much more rounded at the apex and inner edge *distinctly produced into a rounded lobe*, which projects slightly inward. The hind wings do not reach the end of the abdomen, having nearly the same relative length as in *Bunaea*.

Venation: The present genus differs remarkably from *Bunaea* in vein II_1 (first subcostal) arising opposite the middle of the discal cell, and within the origin of the common stalk of veins III_1, III_2 (or subcostal branches 5 and 6). In the hind wings the discal cell is shorter and wider than in *Bunaea*, and the hind edge of the wing is much more elongated, as also vein VII. There are minor differences in the venation, which can only be shown by figures.

Markings: A very small half round transparent discal spot on the fore wings; on those of the hinder pair a very large ocellus, which is nearly opaque, and larger than in *Bunaea*. The discal spots of both wings are represented beneath by a sort of rosette.

Larva.—Body very thick, segments unusually convex, somewhat as in *Telea*, *Tropaea*, and *Antheraea;* the tubercles very much reduced; the median dorsal tubercle low, minute, either very slightly double (*L. phaedusa*) or with no trace of its double origin (*L. tyrrhena*); a pair of silvery white spots on second abdominal segment (in *L. tyrrhena*) apparently wanting in *L. phaedusa*. Suranal plate short, broad, triangular, with minute granulations.

Penultimate stage.—The median tubercle on eighth abdominal segment slightly divided at end; a pair of silvery spots on second and third thoracic and also on second and sixth and seventh abdominal segments. The tubercles and setae more developed than in the last stage.

This genus is proposed for *Bunaea phaedusa* (Drury) and may be named *Lobobunaea* in allusion to the slight lobe on the inner angle of the hind wings. This well known species inhabits western and central Africa. Unfortunately I have only a male for examination, but the female is represented as very similar in form and markings. I regard *Bunaea alcinoë* (Stoll) (*B. caffra* Huebner) as the type of *Bunaea*.

[Other species have since been added to *Lobobunaea*, as *L. callista* Jordan, *L. morlandi* Roths., *L. phaeax* Jordan, and *L. weymeri* Aurivillius.]

Geographical distribution.—[Africa].

LOBOBUNAEA PHAEDUSA (Drury).

Plate XXXIII, figs. 1–5; XLIV, fig. 3; LXXII, fig. 1.

[*Attacus*] *phaedusa* DRURY, Illustrations of Natural Hist., 1780, Westwood's Edit., Pl. XXIV.
Bunaea phaedusa WALKER, Cat. Lep. Het. Br. Mus., V, p. 1229, No. 3, 1885.
Bunaea thompsoni KIRBY, Trans. Ent. Soc. London, 1877, p. 19.
Antheraea laestrygon MABILLE, Bull. Soc. Ent. France, (5) VII, p. CLXXX, 1877.
Bunaea laestrygon KIRBY, Syn. Cat. Lep. Het., I, p. 753, 1892.

Imago.—One ♂. Body and wings fawn-colored. Fore wings with an oblique not wavy extradiscal dark line, situated about halfway between the discal spot and the outer edge of the wing, and ending on the costa before the apex. A middle diffuse line inclosing the discal spot, and a dislocated basal line, the three lines nearly equidistant. A faint bluish oval apical spot. Hind wings with a very large ocellus comprising a large central black field with a whitish minute suboval center, the black encircled by a broad light orange-red circle, this by a pink ring of the same width, and this by an outer irregular diffuse Indian red circle; on the under side of fore wing the discal spot is represented by a round fawn-colored spot, and that of the hind wings by a 4-lobed dark fawn spot.

Expanse of fore wings, ♂ 180 mm.
Length of fore wing, ♂ 98 mm.
Breadth of fore wing, ♂ 50 mm.
Ocellus of hind wing, 26 by 22 mm.

Geographical distribution.—[West Africa.]

Egg.—Finely and regularly reticulated, measuring 3 mm. in length and 2.25 mm. in width. The color is dirty white, banded longitudinally with brown. Laid early in May, in clusters on the under surface of a leaf. [Beutenmüller, Journ. N. Y. Ent. Soc., IX (1901), p. 193.]

Larva.—Length, 92 mm.; thickness 23 mm.

The general shape of the larva is almost exactly as described in *L. tyrrhena*, only differing in slight details. Head and prothoracic plate the same. (In the formalin specimen before me the head and body is darker than in *L. tyrrhena*, but this may be due to state of preservation or the time the larva was killed.) The front edge of the prothoracic plate is a little thicker, and the surface of the plate has scattered minute setiferous tubercles, the setae minute and very short. The thickness of the body and the swollen convex body-segments are the same in both species, entirely justifying the foundation of the genus.

It differs from *L. tyrrhena in the tubercles being more prominent*, and it has retained minute tubercles, with vestiges of the warts or tuberculets on the second and third thoracic and the abdominal segments; these being *absent* in *L. tyrrhena* of the *last stage*, but *present in that next to the last.*

The dorsal tubercles are minute, flattened, smooth, and show traces of a central and five peripheral warts, though the setae themselves are wanting. Those of the abdomen are conical and vary a little in shape, some showing vestiges of one or two warts; those of the supraspiracular and infraspiracular series are minute, conical. The median tubercles on the eighth abdominal segment are small, but double, ending *in two separate darker minute eminences*, whereas in *L. tyrrhena* the *original two are entirely fused*, the single tubercle showing no traces of its double origin, and it is half way between this and the penultimate stage of *L. tyrrhena*, in which they are distinctly seen to be double.

Suranal plate a little narrower triangular than in *L. tyrrhena* and similarly granulated, but the granulations are a little coarser, more numerous and crowded; so with those on the outer edge of the anal legs. *L. phaedusa has also lost* the conspicuous metallic silver spot on the second abdominal segment of *L. tyrrhena*, and the supraspiracular conical tubercle is present, though absent in *L. tyrrhena*. Thoracic legs a little larger and longer, no white on the prothoracic plate in front. There are scattered dark dots over the body above and on the sides. The lateral line is distinct but not yellow. It thus appears that the present species is phylogenetically the older, more primitive form of the genus. Loaned by American Museum of Natural History, Schaus collection.

[The larva is figured by Beutenmüller in Journ. N. Y. Ent. Soc., IX (1901), p. 194.]

Pupa.—Large and robust, with a curved ridge on the anterior part of the thorax. The anal process is long, compressed at the base above and below. The anal segment has two oblong apertures above. [Beutenmüller Journ. N. Y. Ent. Soc., IX (1901), p. 194, and figure on p. 193.]

LOBOBUNAEA TYRRHENA (Westwood).

Plate XXXIII, figs. 6, 7.

Saturnia tyrrhena Westwood, Proc. Zool. Soc. London, 1849, p. 51, Pl. VIII, fig. 1.
Bunaea tyrrhena Walker, Cat. Lep. Het. Br. Mus., V, p. 1229, 1855.
Bunaea tyrrhena Kirby, Syn. Cat. Lep. Het., I, p. 752, 1892.
Bunaea tyrrhena Rothschild, Nov. Zool., II, p. 39, 1895.
Bunaea tyrrhena Sonthonnax, Annales Labr. d'Étude de la Soie, X, p. 36, Pl. XVIII, fig. 2.
Bunaea catochra Karsch. [This is considered a subspecies by Rothschild.]

Imago.—One ♂, one ♀. Antennæ of ♂ widely pectinated; 16 joints with long normal branches and the filiform tip consists of 12 joints, with 9 pairs of vestigial pectinations developed on one side only, and the terminal ones a little longer than the first ones, none of them ciliated, while the normal ones are densely so.

Wings of nearly the same shape as in *L. phaedusa.* The ♂ is soft reddish salmon-brown, especially on the hind wings; fore wings crossed by three lines; the basal one very zigzag, with four sharp points directed inward; those on the subcostal (II) and median (III–IV) veins the largest; the line inside dull salmon to the base, but grizzly towards the costa. Extradiscal line dusky, situated just beyond the small triangular clear discal spot, and consisting of about 8 scallops, the largest and most distinct of which lies in the submedian cell. About halfway between this and the outer edge is a deeply scalloped line of about nine scallops, these and the sinuses between these rounded. Middle of the wing dusky salmon-brown, beyond salmon color; beyond the third line dull salmon; the edge of the wing clear and somewhat hoary.

Hind wings somewhat hoary near and at the margin; within reddish dull salmon, beginning on the inner edge of the basal line and on the second line which fades out before reaching the discal spot. Extradiscal line divided into six or seven scallops, not reaching the costal region. Discal spot large, round, black, paler around the triangular clear center (8 by 8 mm.). On the under side of each wing is a very large group of four to five unequal irregular brown discal spots; general hue of the wings very light salmon fawn color; the two outer lines imperfectly reproduced. Apex brown, and the fringe brown interrupted by the veins. Head, breast, and legs brown.

The ♀ differs much in coloration, being uniformly reddish brown on both wings; the three lines distinct, the middle one touching the discal spot, which is nearly as large as in *Bunaea alcinoë*, but not so wide, not produced inwards or outwards, not so long as wide. Discal spot of the hind wings with the triangular center larger and equilaterally triangular. Underside darker than in ♀ and hoary salmon, and a rather large triangular clear spot in the center of the brown patch in the wings of both pairs.

Expanse of the fore wings, ♂ 126 mm.; ♀ 128 mm.
Length of one fore wing, ♂ 55 mm.; ♀ 58 mm.
Breadth of one fore wing, ♂ 31 mm.; ♀ 30 mm.
Length of one hind wing, ♂ 40 mm.; ♀ 40 mm.
Breadth of one hind wing, ♂ 30 mm.; ♀ 31 mm.

Larva.—Stage before the last: Length 60 mm.; thickness of body 15 mm., width of head 6 mm. Body thick, beneath broad and flat; the segments unusually convex and the sutures wide and deep, with conical tubercles on top of the swollen segments and the transverse ridges surmounting them. Head not quite half as wide as the body in the middle, not very large, though much as in *G. maia;* it is nearly as wide as the prothoracic plate, which is not quite half as wide as the third thoracic segment, the surface finely granulated, pale green. Prothoracic plate small, the surface smooth, subrugose, except on the front edge where there are four rounded conical yellowish tubercles, the two on each side of the median line close together.

The shape, color, and arrangement of the tubercles are much as in *Gynanisa maia,* but they are very much shorter, conical, not much higher than they are broad at the base; the dorsal tubercles of the same size on all the segments, thoracic (first excepted) and abdominal; they are white and conspicuous; only the tubercles of the two dorsal rows are developed and these crown the large fleshy prominences, which give the larva a *Telea* or *Antheraea* appearance; on the crown of the tubercles are two warts (rarely three) which however do not bear setæ.

The second thoracic segment with two long conspicuous pearly silvery transverse slashes of equal size on each side, the upper one ending on the dorsal tubercle, the lower one ending on the minute supraspiracular tubercle; third thoracic segment without the pearly silvery spots, only the minute tubercle remaining. The second, sixth, and seventh abdominal segments are marked with conspicuous silvery pearly spots like the thoracic ones, there being four of them on the upper surface of each segment named; on abdominal segments 1, 3, and 5 the pearly areas are wanting; these spots are directed obliquely backwards.

The median tubercle on the eighth abdominal segment is formed of two twin rounded low conical tubercles, the valley between them being shallow; the tubercles are old ivory color, not being half as high as in *Gynanisa.* On this segment there are no silvery spots, and the supraspiracular tubercles are much reduced, minute. On the ninth segment the two dorsal tubercles are close together, but either one of them is considerably larger than the median dorsal one on the segment preceding, and the base is silvery pearl color.

Suranal plate small, short, not half as long as wide, the tip conical and slightly forked; it is old ivory or yellowish white; the surface with four large conical tubercles, two near the middle and one (the larger) on each side, and among them are about 15 much smaller copal-red tubercles or warts. Spiracles yellowish.

The tubercles of the infraspiracular row are minute, conical, whitish; below this row and on the under side are thickly scattered minute white warts, with a pit in the center, but no seta. Body unusually free from small hairs, all being atrophied.

Anal legs green, a whitish triangular area on the side, the edge along the planta reddish copal yellow. Thoracic feet small, short, yellowish green; abdominal legs (of middle pairs) dark green, short, with a semicircle of greenish setæ.

The larva in this stage is evidently related to *Gynanisa,* but the tubercles are much more reduced, especially those of the supraspiracular row; it thus appears that *Gynanisa* is the more primitive or stem form, and *Lobobunaea* probably evolved from a common ancestor of the two genera.

Last stage: Length 80 mm.; greatest thickness of body about 19 mm.; width of head 7½ mm.

Of the same shape and nearly as large as the larva of *L. phaedusa.* Body unusually thick but not so *Telea*-like as in the previous stage, since the segments are a little less convex, and the convexity on the dorsal side is not added to by the conical tubercles. Head not half so wide as the second segment, and scarcely more than half as wide as the entire prothoracic segment; color green. Prothoracic plate smooth with slight transverse rugose lines; the front edge a little thickened, white on the side, *but with no traces of the four tubercles of the previous stage,* unless one mark or indication of one on one side.

The two dorsal tubercles on the second and third thoracic segments now reduced to *two dark-brown spots,* the skin under them scarsely raised, and no signs of a seta can be detected, while there are *no traces of the silvery marks of the previous stage. No traces of tubercles on the*

abdominal segments, except the slight median tubercle on the eighth abdominal segment, but on the second abdominal segment in place of the dorsal tubercles is a large conspicuous oblique silvery pearly spot 3½ mm. in length and between ⅓ and ½ as wide as long, *the only mark the larva in this stage bears.*

The median tubercle on the eighth abdominal segment is a low dark reddish spot, not a tubercle, and *with no signs of its double origin*, and situated on a low flattened rounded eminence. It is there seen to be more extremely modified than that of *L. phaedusa*, which in the last stage still retains indications of its double origin.

No traces of supraspiracular tubercles over the whole body. No fine or coarse setæ or hairs; no white fungoid warts anywhere on the segments above or beneath.

Suranal plate distinctly triangular, larger than in the previous stage, the end subacute, but not submucronate; the surface rough and the edge thickened, with somewhat crowded granulations—i. e., fine conical warts or tuberculets—which are not, however, setiferous; compared with *L. phaedusa* the tubercles on the suranal plate are much smaller.

Under side of the edge ivory white. Anal legs entirely green, the middle abdominal legs dark green, thoracic legs very short, rather small and yellowish green. Spiracles brownish. Lateral or plural line full, swollen, the edge whitish and connected with the white line on the prothoracic segment.

This larva, in its final stage, in the armature shows some resemblance to *Gynanisa*, but has undergone great reduction in the tubercles, setæ, and the silvery white marks. It is more extremely modified or specialized than the larva of *L. phaedusa*, in which the setæ are still present, though stout and minute. It has retained a single pair of the conspicuous silvery white spots, which appears to be wanting in the single preserved (alcoholic) larva of *L. phaedusa*, while all trace of the double origin of the median tubercle on the eighth abdominal segment is lost.

The larva is evidently, like those of *Telea*, *Tropaea*, and *Antheraea*, which are sluggish, green, and have very convex segments, protected from observation, so much so that the armature is of no advantage and is consequently discarded through disuse.

Although the genus *Lobobunaea* was proposed for but a single species, what we now know of the early stages of the present species amply justifies the separation of this group of forms from *Bunaea;* the larva being so entirely different and so greatly modified compared with those of *Bunaea caffraria* and *alcinoë*.

Described from an individual in each stage kindly loaned by Lieut. Col. J. M. Fawcett.

Food plants.—Celtis kraussiana Bernh., and *Albizzia fastigiata* Oliver, flat crown (Fawcett).

SALASSA Moore.

Saturnia Westwood, Cabinet Oriental Entomology, p. 25, pl. 12, fig. 3.
Antheraea Walker, Cat. Lep. Het. Br. Mus., V, p. 1252; 1855.
Salassa Moore, Proc. Zool. Soc. London, 1859, p. 246.
Salassa Kirby, Syn. Cat. Lep. Het., I [p. 762].

Imago.—Head prominent between the eyes, which are moderately large; the front narrow, and the dense scales on it project out far beyond the eyes, the squamation being more erect and stiffer than in *Bunaea*. Male antennæ long, bipectinated to the extreme tip (those of *Bunaea* being filiform), not so wide and plumose as in *Gynanisa* and *Bunaea;* joints long and slender; basal pectinations not so long as in *Gynanisa* and *Bunaea* or so finely and densely ciliated; bearing two long stiff fine setæ at the end; distal pectinations very short, about one-third as long as the basal ones, and the outer ones very slightly if any longer than the inner ones, and also armed with two or three long stiff slender setæ. No signs of maxillæ. Palpi large and stout, extending beyond the front; third joint distinct, quite free from the second, rounded, button-like, as long as thick; the palpi are much longer, and the third joint is larger, more distinct, than in *Gynanisa* or *Bunaea caffraria*.

Fore wings not so falcate as in *Bunaea*, much more acute at apex than in *Gynanisa*, costa straight, becoming curved toward the apex, which is sharp; outer edge oblique, but not excavated, the edge being straight, not sinuous.

Hind wings much as in *Bunaea caffraria*, the inner angle a little rounded, but not produced into a slight lobe as it is in that genus; the outer edge is regularly curved. The abdomen extends to the outer third of the inner edge of the hind wings, i. e., to the extradiscal line. Legs rather short and stout.

Venation: Vein II_1 originates nearer the base of the wing than usual, in the middle of the discal cell, and much farther inward from the origin of the stalk of II_3 and II_4 than in *Gynanisa;* the discal cell is shorter than in *Gynanisa* and the line formed by the two discal veins is much incurved and makes two decided angles both in the fore and hind wings. Vein II_2 is obsolete, only a minute spur left, which does not reach the costa. The venation in other respects is much as in *Gynanisa.* The veins of both wings are unusually slender and small.

Markings: Ground color reddish fawn, with not very distinct lines; discal spots of remarkable shape in the more specialized species *S. megastica,* that of the fore wings is semioval, the outer side deeply excavated, leaving a large comma-like transparent spot, the tail of the comma directed toward the costa, or a simple quadrangular transparent spot; no deep orange circle around that of the fore wing, but that of the hind wing is more specialized, with different-colored rings, white, red, and black around it. Legs long and slender, fore legs unusually long and slender, hairs short, with no tibial spurs; odoriferous sack about half as long as the tibia, rather blunt at the end, swollen in the middle, or cultriform.

Geographical distribution.—[Asiatic].

[Larva not described. The cocoon consists of leaves and bits of wood spun together.—K. Jordan].

In its venation this genus is as nearly allied to *Gynanisa* as to any other African genus of the family, though the shape of the discal cell is different owing to the curved and angulated line formed by the discal veins. The discal spots of both wings are very remarkable in shape. That it is a highly specialized genus is also seen by the obsolescence of vein II_2. Of the two species *S. megastica* is more specialized and extreme than *S. lola,* which has a normal ocellus on the hind wings.

SYNOPSIS OF THE SPECIES.

Discal spot of the fore wings very small, 4-angled; no ring.....*S. lola.*
Discal spot of fore wings a much larger, transparent, comma-like mark; a larger species; an orange red ring.
S. megastica.
[Fore wings in both sexes with a large round or oval vitreous spot.....*S. royi.*]

[Rothschild (Nov. Zool., II, 1893) lists the species of *Salassa* as follows:]

1. *S. lola* (Westw.) [Silhet].
2. *S. thespis* (Leech) [Ichang], ab. *megastica* (Swinh).
3. *S. olivacea* (Oberth.) [Manchuria].
4. *S. royi* (Elwes) [Sikkim].

[The last three appear in Kirby's Catalogue under *Rhodia.* In 1910 Jordan added *S. mesosa* from Assam and *S. iris* from Sikkim. Jordan has recently (Seitz, Macrolep. of the World) recorded *S. olivacea* from Ta-tsien-lu, West China; it has the thorax and ground color of wings brownish yellow with a greenish tinge.]

SALASSA LOLA (Westwood).

Saturnia lola Westwood, Cabinet of Oriental Entomology, p. 25, tab. 12, fig. 3, 1848.
Salassa lola Moore, Proc. Zool. Soc. London, 1859, p. 246.
Salassa lola Preiss, Abbild. Nachtschmett. p. 4, tab. 3, fig. 2, 1888.
Salassa lola Kirby, Syn. Cat. Lep. Het., I, p. 762, 1892.

Imago.—One ♂. Structure and shape of the body and wings as in *S. megastica.* It is a smaller species, the outline of the wings exactly as in the other species. The abdomen is dusky. Fore wings with the same hue as in *S. megastica,* but the lines and markings are quite different. Basal line dusky and not so much curved as in *S. megastica* and situated nearer the discal spot. The latter is small, a simple small quadrangular opake spot, though with no scales on it, it is curved on the inside and at each end provided with a projection, with a third projection on the outside; it is not surrounded by any ring or scales of any color except a few dark incon-

spicuous ones on the edge. Extradiscal line not scalloped, but composed of a series of light fawn-colored linear spots almost crescentiform in shape. Beyond is a broad diffuse dusky shade, with the edges indistinct and irregularly scalloped.

Hind wings much as in *S. megastica*, but the discal spot is a true ocellus, the naked though not transparent irregularly oval center situated in a black field encircled by a rather broad white line, and this by a deep venetian red ring, outside of which is a clear fawn area, becoming widest toward the costa, the whole enveloped in a heavy wide black ring forming a continuation of the extradiscal line, which is composed of sublunate linear fawn spots. Two outer dusky indistinct lines.

Under side of both wings deep fawn brown inside of the common extradiscal line composed of elongated white lunules; beyond paler, more reddish brown, and the edge of the wing darker, the boundary line between these two shades being zigzag. Discal spot of fore wing as above; that of the fore wings a simple small naked spot, irregularly oval, and not quite so large as that on the fore wing.

Expanse of fore wings, ♂ 105 mm.
Length of fore wing, ♂ 53 mm.
Breadth of fore wing, ♂ 27 mm.
Length of hind wing, ♂ 35 mm.
Breadth of hind wing, ♂ 30 mm.
Discal spot of fore wing, 3 by 2 mm.
Discal spot of hind wing, outside measurement including the black ring, 16 by 12 mm.

Geographical distribution.—[Silhet].

SALASSA (?) THESPIS Leech.

Plate XXXV, fig. 2.

[*Antheræa*] *thespis* Leech [Entom., XXIII (1890), p. 112].
Salassa megastica Swinhoe.

Imago.— ♂ (?). Head, femora, thorax, abdomen, and wings deep orange red, thorax a little redder than the abdomen; antennae black brown.

Fore wings deep reddish orange, with darker scales and darker toward the outer edge; a basal regularly curved broad diffuse frosty gray line nearer the base of the wing than the discal spot. Extradiscal line parallel with the outer edge of the wing, scalloped; it is situated much nearer the discal spot than the edge of the wing. Discal spot comma-like, with a pale fine whitish blue line around it, which is interrupted on the outer side, and which is filled in with dark-brown. A triangular frosty white apical spot. A broad dusky brown submarginal shade, with the edges scalloped.

Hind wings with a discal spot similar to that on the fore wings but larger, rounder, and the pale bluish white line is more complete. This ring is edged with black, and the spot is encircled by a broad deep orange red ring, beyond which is a broad blackish circle, obsolete on the hinder side, very wide and heavy on the costal side, where it is lined externally with white; this outer ring is a continuation of the extradiscal line. Between this and the outer edge of the wing are two dark reddish shades, the outer a narrower zigzag line, losing its zigzag character toward the costa.

The under side of the wings of both pairs is more uniformly chestnut in color and frosted over with white scales. The discal spots have a singular pale greenish glazed tint, with no rings around them. The extradiscal line is common to both wings, that of the fore wings straight, that of the hind wings much curved, ending at the middle of the costal edge, but not reaching the costa.

Expanse of the fore wings, 145 mm.
Length of fore wing, 72 mm.
Breadth of fore wing, 37 mm.
Length of hind wing, 47 mm.
Breadth of hind wing, 42 mm.
Discal ocellus of fore wing, outside, 6.5 by 5 mm.; of hind wings, 13 by 10 mm.

A remarkable species, as its discal spots are so highly specialized and so different from those of its ally, *S. lola.*

Rothschild states *S. megastica* is only a variety of *S. thespis.*

[A penciled note is added by Dr. Packard at the top of the sheet, stating that this species is not a *Salassa.*]

Geographical distribution.—Cherra pungi, Assam. (Ernest Swinhoe).

MELANOCERA Sonthonnax.

Plate XXXVII (*M. menippe*); CVII, figs. c–e.

Saturnia WESTWOOD, Proc. Zool. Soc. London, 1849, p. 43.
Antheraea WALKER, Cat. Lep. Het. Brit. Mus., V, p. 1243, 1855.
Antheraea KIRBY, Syn. Cat. Lep. Het., I, p. 758, 1892.
Nudaurelia ROTHSCHILD, Novitates Zoologicæ, II, p. 43, 1895.
Melanocera SONTHONNAX, Annales Laboratorie d'Etude de la Soie, X, p. 58, 1901.

Imago.—One ♂, one ♀. Head moderately prominent; front moderately wide and square, the sides parallel, the labial region broad, and the surface full and convex; the vestiture rather closely cropped. Eyes moderately large. Antennæ widely pectinated to the tip, not subplumose; the branches being stiff, curved, but not ciliated as in *Nudaurelia;* in ♀ pectinated, the branches longer than usual; joints over 40 in number (Sonthonnax). Palpi rather broad, reaching to but not passing beyond the front; the hairs long and irregular in length, those of the third joint not distinct from the second. Maxillæ not visible. Thorax and body stout, the vestiture of the former rather long and shaggy, but of the abdomen short and close.

Fore wings, broad, not falcate as in *Bunaea,* but more as in *Nudaurelia,* though less subfalcate and subacute; costa slightly arched toward the apex, which is somewhat rectangular; outer edge slightly convex. Hind wings full and rounded on the outer edge; apex and inner edge full and rounded.

Venation: Differing from that of *Nudaurelia* (*N. cytherea*) in the first subcostal vein (II_1) being short and arising far beyond that of III_1; the discal cell is much shorter than in *Nudaurelia cytherea,* the discocellulars being within the middle of the wing; that of the hind wing much as in *Nudaurelia.*

Markings: Ground color reddish crimson, with white basal and extradiscal lines; ocelli in wings of both pairs large, a large black center encircled with white, the center with no clear spot. A white band on the collar.

This genus may be recognized by the widely and stiffly pectinated black antennæ; the branches extending to the tip, and not ciliated as they are in *Nudaurelia,* and those of the ♀ well pectinated to the tip. The third palpal joint is not distinct, but nearly concealed by the hairs of the end of the second joint. The fore wings are not even subfalcate; the apex is squarish, the outer edge a little convex; the hind wings are full and rounded; both the apex and inner angle rounded. It differs from *Nudaurelia* in the ♂ antennæ not being subplumose; those of the ♀ being well pectinated, while the wings differ in shape as already stated. The genus is evidently an offshoot of and nearly related to *Nudaurelia.*

The characters given by Sonthonnax are simply (except the antennal ones) based on the markings, the ocelli and lines, and are necessarily superficial; the differences in the venation of the fore wings being very marked, though only one ♀ was examined. Sonthonnax enumerates three species, of none of which the larva is known.

The antennæ of the ♀ I have examined are broken off, leaving, however, two or three basal joints, with rather long branches. Sonthonnax's figure of *M. sufferti* ♀ is figured with branches but a little shorter than in the male, and extending to the tip.

Geographical distribution.—Southern and central Africa, including the upper Congo region. The commonest species (*menippe*) occurs in Natal and the Transvaal; *M. sufferti* at Lake Victoria Nyanza and Lake Tanganika, while *M. nereis* inhabits the upper Congo region.

[The type of the genus is *M. menippe* (Westwood). Rothschild has described a subsp. *umosa* of *menippe* from East Africa. *M. parva* Rothschild, 1907 (Nov. Zool. 1908, Pl. IX, fig. 8), is from Angola. Wichgraf in 1911 published *M. menippe* ab. *habenichti* and ab. *transiens.*]

AURIVILLIUS Packard.

[*Aurivillius* Packard, Journ N. Y. Ent. Society, X (1902), p. 104.]
[*Euaurivillius* Packard, t. c., p. 105.]

AURIVILLIUS ARATUS (Westwood).

Saturnia arata Westwood, Proc. Zool. Soc. London, March 27, 1849, p. 41, Pl. VII, fig. 2.
Antheraea arata Walker, Cat. Lep. Het. Br. Mus., V, p. 1240, No. 1, 1855.
Antheraea arata Maassen and Weymer, Beitrage zu Schmett., IV, fig. 59, 1881.
Antheraea arata Kirby, Syn. Cat. Lep. Het., I, p. 757, 1892.
Nudaurelia arata Rothschild, Novitates Zoologicæ, II, p. 43, 1895 and ab. form *fusca*.
Nudaurelia arata Sonthonnax, Annales des Laboratoire d'Etudes de la Soie, X, p. 23, 1901.

Imago.—One ♂. Ground color of the body and wings ocher-yellow; collar, breast, and all the legs sable brown. Head at base of the antennæ white; tegulæ white, thorax and abdomen yellow.

Fore wings with six cross lines; yellow with a broad diffuse pink shade, beyond which is a narrow four-scalloped brown line most distinct in the discal space; a doubly scalloped narrow dark line just beyond the discal spot, each scallop divided into sharp secondary ones. About half way between the discal spot and edge of the wing is a fine dark brown line, not scalloped, and parallel with the outer edge. The outer margin of the wing is broadly lined with dull lilac and incloses a yellow seven-scalloped line, the points of the scallops thicker, and the apex of the wing yellow.

The discal spot about one-third as large as that on the hind wings, roundish oval, the center clear, crescentiform, minute, edged externally with black scales; the outer portion of the spot pale reddish, encircled with deeper red.

Hind wings yellow, the yellow and dark lines nearly repeating those of the fore wings. Discal spot large, reddish, the center black, not clear, D-shaped; a lilac circle between the inner paler red and the outer deep venetian-red circle.

The extradiscal line is narrow and nine-scalloped; the scallops largest and most marked toward the inner edge. Between the discal spot and the inner edge are two unequally zigzag brown lines.

Beneath, the wings are as above, though of a faded hue, and the lines fainter. Discal spot of fore wings about half as large as above and nearly as large as the discal spot of the wings of the hinder pair, the latter being centered by a short black line.

Expanse of the fore wings, ♂ 130 mm.
Length of a fore wing, ♂ 60 mm.
Breadth of a fore wing, ♂ 34 mm.
Length of a hind wing, ♂ 40 mm.
Breadth of a hind wing, ♂ 32 mm.

Geographical distribution.—Nearly the entire Ethiopian realm. Westwood gives the following localities: Ashantee, Sierra Leone, and Port Natal. The specimen from which my description was drawn up was sent me by Mr. J. T. Queckett from Durban, Natal, the moth having appeared in November, 1901.

Mr. Rothschild gives the name *fusca* to an aberrant specimen from Natal which has the ground color reddish chestnut instead of yellow. He adds: "Sierra Leone specimens of the female are much brighter, and the patterns are more distinct than Natal specimens, while Sierra Leone males are paler in color and the markings more restricted."

Subfamily 4. Cyrtogoninæ Packard. [Micragoninæ.]

[*Cyrtogoniinæ* Packard, Psyche, February, 1902, p. 306.]

[The original diagnosis is as follows:]

Antennæ of ♂ with a single pair of pectinations to a joint, in venation differing from that of the other groups, in veins II_1, II_2, and II_4 [III_1, etc., in revised nomenclature] of the fore wings all originating at nearly the same point, quite far beyond the outer end of the discal

cell. This is an entirely provisional group (perhaps an offshoot from the Bunaeinæ), as my material is imperfect, and we know nothing of the transformations of the single genus *Cyrtogone*. [The larva is now known.]

[The following fuller account was left in manuscript:]

Body stout; head of moderate size, fairly prominent; front rather wide, narrowing a little toward the labral or oral region; eyes rather large; antennæ of male bipectinated, in form like those of *Sphingicampa*, with about 20 joints with 2 pairs of densely ciliated branches; in female a single pair of stout pectinations; the terminal fourth of the antennæ filiform; palpi thick, stout, obtuse at the end; maxillæ fairly well developed, very slender, separate, but if unrolled they would be nearly as long as the palpi, i. e., would reach nearly to their tip. Fore wings broad, falcate; the costa suddenly bent back near the apex, which is broad and squarish; outer edge rather deeply excavated; inner angle rounded. Hind wings broad and short, apex short, rounded; outer edge irregularly scalloped; in the female the inner angle reaches to the end of the abdomen. The sexes much alike, varying in distinctness, the shape of the male wings differing from those of the female in being deeply excavated on outer edge. There are 11 veins in the fore wings and 8 in the posterior ones; the venation differs from that of other groups in that veins II_1, II_2, and II_4 [$=III_1$, etc.] of the fore wings all originate at or near the same point, quite far beyond the outer end of the discal cell; vein III_2 not independent, i. e., not detached. (For further details see the characters of the genus.)

While the markings are irregular mottlings, there being no discal ocelli or spots, there is a broken, more or less distinct basal and extradiscal line, the latter tending to become obsolete.

This moth was originally referred to *Saturnia* by Westwood, and though afterwards assigned a position in the Pinaridæ by Kirby, it does not seem to have any true affinity with that family. The group is apparently an offshoot from the Bunaeinæ, judging by the venation, the shape of the head, and the development of the palpi and maxillæ, and the present position assigned to this most interesting genus must be regarded as purely tentative and provisional. It is a very specialized group, apparently preserved by its mimicry of dead leaves. Eggs taken from the abdomen are large, round, spherical, like those of Saturnians.

Geographical distribution.—Restricted to the Ethiopian realm, one species confined to Sierra Leone, and the other inhabiting southern Africa.

[*Cyrtogone* being a synonym of *Micragone*, the subfamily must take the name Micragoninæ. The species are actually rather numerous. Sir G. F. Hampson writes (litt. May 13, 1912): "*Cyrtogone herilla* is certainly the same genus as *Micragone agathylla*. We have seven species under *Cyrtogone*, several undescribed."]

MICRAGONE Walker.

Saturnia Westwood, Proc. Zool. Soc. London, 1849, p. 57.
Micragone Walker, Cat. Lep. Het. Brit. Mus., VI, p. 1342, 1855.
Cyrtogone Walker, Cat. Lep. Het. Br. Mus., VI, p. 1343, 1855.

Imago.— ♀. Head of moderate size, indeed rather small, fairly prominent; eyes moderate in size. The front of the head is rather wide, full, and convex, the vestiture rather close. Antennæ of ♂ bipectinated much as in *Sphingicampa;* rather broadly branched, about 20 sets of branches which are even in length on each joint. Antennæ of ♀ with long, well developed thick pectinations on the basal two-thirds, densely ciliated; tip filiform, composed of about 12 joints, with fine short slender pectinations, the distal third thick, with a pair of short minute setæ representing the pectinations. Only a single pair of pectinations to a joint; the joints themselves are a little longer than wide in the middle. Palpi thick and short, blunt, not extending to the front of the head; third joint minute, not distinguishable, conical, very small (Walker). "Proboscis extremely short and feeble" (Walker). In *M. cana* the maxillæ separate, minute, not reaching beyond the middle of the palpi. Thorax in shape much as in *Sphingicampa*, being high and full, overhanging the head.

Fore wings of the ♂ narrow and falcate; those of the ♀ wider; in ♀ the costa is straight on the basal two-thirds, bent backward in a peculiar way on the outer third; the apex much arched, broad and squarish, and the outer edge below is rather deeply excavated, and in *C. herilla* scalloped or denticulated, giving it a frayed or ragged appearance, but in *C. nenia* they are entire.

Hind wings short and broad; the apex rounded; the outer edge full and convex; the inner angle slightly produced, reaching to the end of the ♀ abdomen.

Venation: Remarkable from the fact that veins II_1, II_2, and II_4 all originate at (*M. herilla*) the, or near the same point, quite far beyond the discal cell, and also beyond the middle of the wing; veins III_1 and III_2 arise from a common stalk quite far beyond the discal veins; each discal vein situated at about the middle of the wing, points inward, the upper one partly obsolete; hind wings approaching type of *Urota;* origin of vein II within the middle of the discal vein and near the base of the wing, and quite remote from origin of vein III_1; discal veins together forming an oblique line directed outward and a little incurved.

Genital armature: Suranal plate triangular, ending in a very long slender spine bent down at right angles (*M. nenia*) or short and incurved (*M. herilla*), claspers oval, large and spreading, sternite produced and spiny (*M. nenia*); penis long, cylindrical.

Legs moderately long and thick, with vestiture long; fore tibial scent appendages (nartheca) minute, much smaller than usual, about one-fourth as long as the tibia, thick, triquetal, oval, lanceolate, tip not very sharp.

Markings: The ground color is a singular fawn-brown, mimetic of the hue of a dead leaf. No definite lines except obscure one in fore wings of *M. nenia* ♂ or traces of discal spots; the base of the hind wings to the middle pale yellowish.

This is an extremely specialized form with moderately long but very slender maxillæ. It will probably be found to be remarkably mimetic of a dead leaf. By Walker the genus was placed near *Molippa sabina* and by Kirby in the Pinaridæ. The venation of the fore wings is unique, but that of the hind wings is of the type of *Urota.*

Geographical distribution.—The genus is confined to the African continent, *M. herilla* occurring at Sierra Leone and *M. nenia* at Cape Palmos and Sierra Leone, *M. agathylla* to Congo, *M. lichenoides* to Ogové, while *M. cana* inhabits the Delagoa Bay region.

Larva.—Body heavily armed with long stout sharp smooth spines; the dorsal thoracic and median spines on eighth urite a little longer and larger than the others on urites 1 to 7; the median spine on the eighth urite twice as thick as the others and deeply divided a quarter of its length; prothoracic collar unarmed; suranal plate unarmed; skin black, with two rows of flattened white rosette like warts; others collected about the spiracles.

SYNOPSIS OF SPECIES.

Fore wings in female not excavated [*Micragone*]:

Chestnut and red; male pink on costal edge of hind wings; male and female with two black-brown lines on fore wings, and hind wings with a large whitish patch ..... *M. nenia.*

Pale ochreous; lines wanting; costal region beneath pinkish; size small ..... *M. cana.*

Fore wings olive gray, striated with green-gray; black basal line; outer angle and apical third vandyke brown, with intricate black zigzag submarginal lines ..... *M. lichenoides.*

Fore wings subfalcate; hind wings denticulated; reddish buff; hind wings on costal edge pink above; traces of an outer black line on fore wings ..... *M. agathylla* [type of *Micragone*].

Fore wings in female excavated [*Cyrtogone*]:

Wings mottled with chestnut; no definite lines; female with a large central cream patch on hind wings; size large ..... *M. herilla.*

[*M. lichenoides* (Holland), from West Africa, was described in Psyche VI (1893), p. 533. *M. ansorgei* (*Cyrtogone ansorgei* Rothschild), from Angola, was described in Ann. and Mag. Nat. Hist., 1907, and figured in Nov. Zool. 1908, Pl. IX, f. 7.]

MICRAGONE HERILLA (Westwood).

Plates XXXIII, fig. 8; CXI, figs. h, i.

[*Saturnia herilla* Westwood, Proc. Zool. Soc. Lond., 1849, p. 57, pl. 11, fig. 3.]
Cyrtogone herilla Walker, Cat. Lep. Het. Br. Mus., VI, p. 1344, 1855.
[*Cyrtogone herilla* Kirby, Syn. Cat. Lep. Het., I, p. 856.]

Imago.—One ♂, one ♀. Palpi stout, reaching to front. Antennæ with 16 joints, each bearing two sets of pectinations, which are thick, densely ciliated, the distal ones nearly as long as those of the basal pair; the tip long filiform, consisting of about 15 joints, and slightly ciliated, with no vestigial pectinations.

Fore wings somewhat like those of *Smerinthus*, long and narrow, the costa straight on the basal two-thirds, then suddenly bent backwards to the square, scalloped apex; outer edge deeply excavated, and with about seven scallops; the inner edge long, remarkably straight. Hind wings with the costa convex, the apex rounded and scalloped behind; outer edge moderately convex, with about eight scallops, the two in the middle largest, and the inner angle produced into the longest point of all. The hind wings reach nearly to the tip of the abdomen.

Body and wings of a rich velvety lilac-brown, or color of a dead dry leaf, with no definite lines or spots, but many (about 12) irregular subparallel rich brown lines, which are more or less broken, and are most marked on the costal and inner edges of the wing. No discal spot. Around the sinus of the outer edge of fore wing is dark brown like a dark withered leaf. Hind wings pink at base, with many very irregular faint lines; the outer edge dark, as in the fore wings. The marks on the inner edge are distinct.

Under side of the fore wings of a deep rich pink along the inner margin of the wing, otherwise both wings are much as above, though the lines and their broken fragments are more marked and heavier. There is no large conspicuous pale yellowish spot on the fore wings as in the ♀.

One ♀. Head and body uniformly reddish fawn or chestnut brown, or brown pink of artists, and the wings are of the same color, often becoming vandyke brown mottled with sienna brown and pale ochre yellow. They are crossed by irregular strigæ and variously dotted and spotted. Fore wings with a dark diffuse basal line, which is irregular, curved outward on the costa; beyond it the wing is lighter. The outer half of the wing is uniformly fawn-brown, and between veins III and III_3 is an oval dark brown spot; the edge of the wing from the apex to just before the inner edge dark chestnut or vandyke brown. Edge of wings of both pairs ragged, irregularly scalloped or toothed. Hind wings with a large pale yellowish patch at the base, where there is a little pink, extending to the middle of the wing, but not toward the costa beyond, the inner edge is strigated.

Under side of the wings as above, but with more ochreous scales, and the base of the fore wings except the costa is pinkish. There are traces of a much curved extradiscal dark line toward the apical region.

Expanse of the fore wings, ♂ 95 mm.; ♀ 110 mm.
Length of a fore wing, ♂ 43 mm.; ♀ 55 mm.
Breadth of a fore wing, ♂ 20 mm.; ♀ 30 mm.
Length of hind wing, ♂ 25 mm.; ♀ 38 mm.
Breadth of hind wing, ♂ 18 mm.; ♀ 30 mm.

This is a most remarkable moth, its sere and brown colors, and ragged edges would make it when at rest be mistaken for a dead, frayed, worn and tattered leaf.

As the venation somewhat allies it with that of the Bunaeidæ, we may at present regard it as an offshoot from that group or from its ancestors, which has undergone a remarkable degree of specialization. The presence of a feebly developed tongue is of some significance.

Larva.—Fully grown, length 50 mm. Head large, full, rounded, nearly as wide as the prothoracic collar; with scattered groups on surface of fine raised granulations, 3 to 5 in a group, dark chestnut-brown. Prothoracic collar large, but little wider than the head, *entirely unarmed;* the surface somewhat rugose. Directly in front of the prothoracic spiracle is a low

but rather large oval swelling, the vestige of a tubercle, which bears five to six setæ. Further down at the base of the first pair of legs is a low broad chestnut-colored tubercle, not so high as broad, and bearing six setæ.

On the second and third thoracic and all the abdominal segments are eight rows of long stout very sharp smooth spines, curved backward, those of the two dorsal rows a little longer than those of the supraspiracular rows. *The dorsal thoracic and median spine of 8th abdominal segment a little longer and larger* than the other abdominal ones. Each spine bears five or six long pale setæ, radiating from the main stem. All of the spines are of the same pale chestnut or deep reddish yellow hue, tipped with dark. *The dorso-median spine on the eighth abdominal segment is twice as thick as the others and deeply forked to a quarter of the length*, and there seems to be faint indications of a median impressed line, as if the fusion of the two spines had occurred late in larval life.

The spines of the lowest series near the base of the legs are stout, but shorter and black. On the ninth abdominal segment are six rows, the four dorsal ones large, nearly as long as those of the eighth segment and curved backward.

The suranal plate is large, round, smooth, but the surface is rugose and with scattered small piliferous warts; the edge thicker, but not spiniferous. Anal legs large, thick, triangular.

The body is black, the thoracic and abdominal legs black, except those of the anal pair and the suranal plate, which are bright chestnut red.

Like the larva of *Urota*, the upper surface of the *second and third thoracic segments are showily and brightly ornamented with a transverse row on the front and hind edge of each segment of white rosettelike flattened soft warts*, which are round where not crowded; but when crowded tending to become polygonal and to bear in the center a papilla, or sometimes there are two excentric ones; the lines formed by these warts are more or less wavy. The spiracles are encircled by them, being sometimes two or three deep. On the dorsal side of the segments they tend to be arranged in the form of a W.

This larva, which is very well preserved, was kindly loaned me by the American Museum of Natural History, through Mr. W. Beutenmüller. It is No. 335, and is from the collection presented by Mr. William Schaus. It was received by him from Sierra Leone.

In general appearance it resembles the larva of *Bunaea caffraria*, but more especially *Acanthocampa belina*.

MICRAGONE CANA Aurivillius.

Cyrtogone [*cana*] Aurivillius, Ent. Tidskrift, p. 202, 1893.
Cyrtogone cana Rothschild, Novitates Zoologicæ, II, p. 51, 1895.

Imago.—One ♂, one ♀. A very much smaller species than *M. herilla*, the ♀ differing from the ♀ of that large species in the outer edge being more oblique and entire, while the hind wings are not ragged along the edge. Head and body reddish tawny. [The venation also differs.]

Fore wings long and narrow, costa slightly incurved on the basal two-thirds, beyond much arched; apex broad and square, outer edge deeply excavated and the edge with the fringe is very slightly uneven, almost scalloped; inner edge very long. No lines, discal spots, or other distinctive markings. The wing is tawny dull ochreous or buff yellow, washed with pink and reddish, and dusted with reddish-brown scales; costa spotted with brown, as is the outer edge and fringe, also the inner edge; as signs of a discal spot.

Hind wings clearer buff yellow, with violaceous and reddish short wrinkled lines at the inner angle and along the inner edge, but no lines crossing the wing and no discal spots. Under side of the fore wings paler, with a large distinct deep pink patch between the costal and inner edges of the wing, and the brown costal spots are larger and more distinct than above.

♀. Considerably larger than ♂, fore wings with the apex rounded, not square, broader than in the ♂, but slightly falcate; buff yellow, costal and inner edge marked with short transverse reddish-brown stripes; outer edge entire and fringe concolorous with the rest of the wing, but with a few pink red scales behind the apex and at the inner angle. A faint oblique

slightly curved broad diffuse brownish extradiscal line, fading out before reaching the apex; patches of whitish gray along the inner edge.

Hind wings with two slight excavations, one in the middle of the edge, and the other at the inner edge; the wings clear buff, of the same hue as the fore wings; colored with pink along the base of the subcostal vein. No discal spot; no lines, except the beginning on the hind edge of a brownish line; inner edge white and with some reddish scales. Beneath as above.

Expanse of the fore wings, ♂ 48 mm.; ♀ 58 mm.
Length of a fore wing, ♂ 21 mm.; ♀ 28 mm.
Breadth of a fore wing, ♂ 10 mm.; ♀ 18½ mm.
Length of a hind wing, ♂ 15 mm.; ♀ 20 mm.
Breadth of a hind wing, ♂ 10 mm.; ♀ 14 mm.

This species differs from *M. herilla* in its much smaller size, the entire fore wings, which are longer in proportion, with the outer edge more oblique; the hind wings are not ragged as those of *M. herilla*.

Like the other species *M. cana* is without lines or discal ocelli, and the buff yellow wings are clear of the crowded reddish brown strigae and fine marks of the larger species. Like that also, and the other small species of the genus from West Africa, the colors are those of dead leaves, and appear to be with little doubt protectively mimetic, the moths living concealed when at rest among dead and dry leaves.

It may almost be taken for granted that moths colored like those without prominent brightly colored lines and bars and without conspicuous and gaily painted ocelli, owe a certain degree of immunity from the attacks of lizards and birds to their resemblance in color as well as perhaps shape when at rest to the dead dry leaves among which they nestle.

Geographical distribution.—So far as known confined to the southeast coast of Africa, one specimen being reported from Delagoa Bay, Portuguese Possessions, south latitude 26°.

MICRAGONE NENIA (Westwood).

Saturnia nenia WESTWOOD, Proc. Zool. Soc. London, 1849, p. 57, Pl. IX, fig. 3.
Cyrtogone (?) *nænia* WALKER, Cat. Lep. Het. Brit. Mus., VI, p. 1344, 1855.
Cyrtogone nenia KIRBY, Syn. Cat. Lep. Het., I, p. 856, 1892.
Micragone nenia KARSCH, Ent. Nachrichten, XXII, p. 254, 1896.

Imago.—One ♂, one ♀. Antennæ of ♂ with 19 to 20 sets of pectinations, the basal and distal branches of the same length and very densely ciliated; tip filiform, consisting of 12 joints, with minute short tooth-like vestigial branches each ending in a cilium; ♀ with longer pectinations than in *M. herilla*. Palpi short, blunt, third joint not distinct, not reaching the front.

Fore wings very falcate; costa straight on the basal two-thirds and then suddenly bent backwards, while the apex is square and broad; outer edge deeply excavated and scalloped, the scallops not so ragged and irregular as in the ♀, in which the fore wings are wider and not so falcate and concave; indeed in this species the outer edge in ♀ is full, not concave at all, though the edge is irregularly scalloped and ragged.

Hind wings short and broad, much rounded at the apex; outer edge in ♂ with three scallops, deepening toward the middle of the outer edge; the inner angle somewhat squarish; in ♀ not quite reaching the end of the abdomen.

Body and wings of ♂ the color of a dead leaf, being light reddish brown with chestnut or vandyke brown patches and dusted with lilac scales, being nearly of the same general hue as ♀ of *M. herilla*. Fore wings with a fine narrow basal zigzag line bent outward in the discal cell; no distinct extradiscal line. A large vandyke-brown patch on the outer half of the wing, not reaching the costal region or the inner angle; between it and the costa on the outer third are three slashes, the two larger ones dark brown, edged with red ocher.

Westwood describes and figures "an ill-defined fulvous-buff patch in the middle of the wing," but this is obsolete in the specimen before us.

Hind wings pink on the costal region, with no definite lines; outer edge and posterior half colored as in the middle of the hinder part of the fore wings.

Under side of fore wings half pink toward the inner edge; costa with brown spots and a sinuous row of five isolated irregular distinct lunate dark reddish-brown spots on the outer fourth of the wing; the wing along the scalloped outer edge is deep vandyke brown. Hind wings coarsely mottled with reddish brown and lilac; an irregular extradiscal line of lunate brown spots.

The female is very different in its shape, size, color, and markings. It differs from the ♂ in its much larger size, in its antennæ having but a single pair of pectinations to a joint, and in its much less falcate wings and uniform dark-brown hue, which is a peculiar dark ash-brown, the color of a very dark dead leaf; the fore wings are not so falcate and the outer edge not so deeply hollowed out as in *M. herilla* ♀.

Fore wings with no reddish scales except toward the apical region. A black-brown zigzag basal line situated rather far from the base of the wing, the most distinct angle lying in the discal cell. Extradiscal line parallel to, but far from the outer edge and bent back at a right angle on the costa.

Hind wings concolorous with those of the anterior pair; no lines, but a very large roundish cream-white spot on the inner half, not reaching the costal or the inner edge. No discal spots on either wing.

Under side of fore wings as dark as above; extradiscal line distinct and interrupted by an irregular large elongated cream-white spot; along the inner edge is a wide deep pink area. Hind wings as above but more reddish-ash, the white spot as above. As this species has retained the two lines on the fore wings, it seems to be a more primitive species than *M. herilla*, in which they are obsolete.

Expanse of fore wings, ♂ 70 mm.; ♀ 86 mm.
Length of one fore wing, ♂ 35 mm.; ♀ 42 mm.
Breadth of one fore wing, ♂ 11 mm.; ♀ 21 mm.
Length of a hind wing, ♂ 22 mm.; ♀ 30 mm.
Breadth of a hind wing, ♂ 18 mm.; ♀ 21 mm.

This, like *M. herilla*, is very obviously protective in the form, colors, and outline of the wings, and shows a remarkable resemblance to a dead, torn leaf.

Subfamily 5. Eudæmoniinæ Packard.

[*Eudæmoniinæ*, Packard, Psyche, February, 1902, p. 306.]

An aberrant group not improbably of full family rank, perhaps belonging after Cyrtogoninæ, or near Urotinæ. The single genus is remarkable for the excessively long tails of the hind wings, the long slender palpi, the end of the second joint extending just beyond the front, and the third joint very long; and the venation. Head in front squarish; when denuded of scales flat, scarcely narrowing in front. Antennæ of ♂ with but a single pair of pectinations to each joint. Maxillæ very slender, not united, but nearly half as long as the palpi. Fore wings short and broad. Hind wings small, triangular, the tail being from three (♀) to five times (♂) longer than the main portion of the wing. Venation approaching that of *Urota*; 10 veins in the fore wings, only 7 in the hind ones. The venation of the wings of the hinder pair is evidently affected by the great development of the "tail," which is strengthened by the three veins (III_3, IV_1, IV_2), no vein V (internal) detected. The discal veins ("discocellulars") very unlike that of *Urota* or any other genus, and together forming a very oblique, bent, or angulated line. The body is slender; the legs long and slender; the fore-tibial epiphysis rather long and about two-thirds as long as the tibia itself; the abdomen slender, that of the ♀ clothed at the end with a large singular mop-like mass of dense, short battledoor-like scales, with a lateral tuft on each side.

The ♂ genitalia show some remarkable features which we have not met with in this or allied families. While the claspers are in the main like those of *Sphingicampa*, etc., the suranal

plate differs in shape and armature, being small and short, with a basal pair of small spines, and a second much longer pair directed backward.

[A later memorandum by Dr. Packard is as follows:]

Eudæmoniidæ; perhaps family. [Larva] with many setæ on tubercles, but on trunk as well as at top. Evidently derived from *Bunæa* group. (Bunæinæ have no prothoracic spines, none on suranal plate, and all spines simple, unisetose.)[1]

EUDAEMONIA Hübner.

Bombyx Fabricius, Species Ins., II, p. 170, 1781; syst. Ent., p. 414.
Eudaemonia Hübner, Verzeichniss bek. Schmett., p. 151, 1822?
Saturnia (Eudaemonia) Westwood, Edit. Drury, I, Ill. Exot. Insects, III, p. 39, 1836.
Eustera Duncan, Naturalists' Libr., Exot. Moths, p. 125, 1841.
Eudaemonia Walker, Cat. Lep. Het. Br. Mus., VI, p. 1265, 1855.
Eudaemonia Kirby, Syn. Cat. Lep. Het., I, p. 767, 1892.

Imago.— ♂ and ♀. Head moderately large, front squarish, the sides parallel, not converging in front. Eyes rather large. Antennæ plumose, pectinated to the tip, slender, joints in the middle long, about twice as long as broad and slender; the pairs of pectinations are remote from each other, and there is only a single (the basal) pair to a joint; the branches are long and slender, considerably longer on the outside than on the inside, with very fine cilia. The palpi are very slender and of remarkable length; the end of the second joint extending just beyond the front; the third joint is very slender, long and pointed, nearly as long as the second joint, and slightly thickened at the end. The maxillæ are present but very slender, separate, nearly half as long as the palpi. The body is slender, weak, and the thorax is not very thick.

Fore wings short and broad, costa straight on the basal three-fourths, convex toward the apex, which is obtusely pointed; outer edge full and convex, a third longer than the inner edge (which is straight) and bent in the middle, while the edge is slightly scalloped. Hind wings small, narrow, and (except the tails) triangular; costal edge slightly curved; apex much rounded; outer edge straight, slightly scalloped; inner angle produced into a phenomenally long narrow "tail," flaring or widening toward the end which is paddle shaped and twisted and sublobate, the tail being from about three (♀) to five (♂) times as long as the main portion of the wing, which latter extends a little beyond the end of the abdomen.

Legs long and slender; on the first pair of tibiæ (of both sexes) is a rather long, large epiphysis, about two-thirds as long as the tibia itself.

Abdomen slender, the tip rather obtuse in ♂, concolorous with the body, but that of ♀ broad, rounded, and clothed with very short dense scales, with two lateral tufts on each side (scent sacks?).

Venation: In fore wings somewhat as in *Urota;* but vein II_1 arises as in *Ludia,* half way between the origin of vein II_3 and of the common stalk of veins III_1 and III_2; no vein II_2; form and size of the discal cell as in *Urota;* vein III_3 a little nearer the middle of the extradiscal space than in *Urota;* discal veins forming a single short straight line situated half way between the base and the end of vein III_3; origin of branches of the median veins (III_3 and IV_2) as in *Urota.* Hind wings not greatly departing from the type of *Urota* and *Ludia,* though much affected by the shape of the wing, and the enormously long tail; vein III_2 about one-half as long as III_1, the space between these and veins II and III_1 very wide and short; vein III_3 ending on the inside of tip of the tail; IV_1, on the outer side of the tip, and IV_2, on the basal third of the tail; they arise at nearly equal distances apart, and the discal veins together form an oblique bent line.

[1] [The very distinct genus *Copiopteryx* Duncan, the species of which have been confused with *Eudaemonia* on account of the form of the the wings, was not studied by Dr. Packard. The moths have very long tails on the hind wings, and occur in South America. The species in the U. S. National Museum may be tabulated thus:

Primaries with no fenestra on outer side of postmedian band; discal fenestra greatly elongated, more or less L-shaped; outer margin of primaries not dentate or crenulate ... *derceto* (Maass. & Weym.)

Primaries with a fenestra on outer side of, touching, postmedian band.

Primaries with a large, dark, discal blotch, but no median dark band, the fenestra very small ... *jehovah* (Strecker); French Guiana.

Primaries with a transverse, suffused, variable dark median band; outer margin of primaries very strongly and coarsely crenulate-dentate ... *sonthonnaxi* André; Rio Janeiro.

Primaries with no median zigzag band; tails of hind wings excessively long and slender ... *semiramis* (Cramer); Rio Janeiro and British Guiana.]

Markings: Body and wings of a beautiful delicate uniform pink or brown, with several transparent eye-like spots in the middle of the wings and some outside of the discal cell.

This remarkable moth is at once distinguished by its extraordinarily long tails. That they at least do not aid flight is indicated by the statement in Drury: "Its flight is exceedingly slow, and its tails seem rather to impede it." (Illustrations.) The remarkable length of the palpi is noteworthy, as well as the presence of maxillæ.

The genus appears to be an offshoot from some *Urota* like genus, and in its venation is allied to *Urota*. It evidently forms a group by itself of subfamily rank.

Geographical distribution.—Thus far it is only known from the west coast of Africa, Sierra Leone.

Larva.—Head a little above the median size, roundish. Body cylindrical, rather thick, and heavily armed with stout spinulated tubercles; those of the thoracic segments in eight rows, four rows on each side, while there are six rows, as usual, on the abdominal segments. The tubercles of the two dorsal rows on the prothoracic collar are short and moderately high. Those of the second and third thoracic segments and the median tubercle on the eighth abdominal segment are a little larger than the other abdominal ones, the tubercles are large, the base fleshy, above solid chitinous and bearing very stout spines of unequal size, two being terminal and forming a fork.

The median spine on the eighth abdominal segment larger than the other abdominal ones, bilaterally symmetrical, ending in four spike-like spines, two on each side, those of one pair diverging from those of the other.

Suranal plate large, thick, rounded, and armed with an unusually large spinulated spine on each side a little beyond the middle of the plate; in shape like those of the supraspiracular row on the eighth abdominal segment. Anal legs large, subtriangular, sphingiform; granulated and setose.

Stage before the last.—The dorsal tubercles of equal size and height both on the thorax and abdomen; the terminal spine of each tubercle longer than in the last stage, erect. The two inner tubercles of the prothoracic collar simpler and slenderer than the others, ending in a single spine. Suranal plate as in the last stage.

Pupa.—Of unique shape and type of armature; body flattened, head and end of abdomen inclined downward; eyes rough, hedged in with irregular setæ; wing covers with transverse rows of scraggy setæ; no visible indications of mouth-parts and legs; abdomen ending in three points, the middle one the cremaster, a flattened tooth; a mucronate tooth on each side, all armed with stiff appressed setæ pointing backward; beneath at base two deep pits; no terminal hooks. A highly specialized pupa, extremely modified, apparently from the Sphingicampid type.

EUDAEMONIA BRACHYURA (Drury).

Plate XXXI, figs 8, 9.

Attacus brachyura Drury, Illust. Exot. Ent., III, Tab. XXIX, fig. 1, 1780.
Bombyx argus Fabricius [Species Ins., II, p. 170, No. 17, 1781].
Phalaena Attacus brachyura Stoll, Papillons Exotiques, III, Tab. XXIX, fig. 1, 1782.
Phalaena-Attacus argus Stoll, Papillons Exotiques, p. 127, Pl. XXVII (1787).
Eudaemonia uroarge Hübner, Verz. bek. Schm., p. 151, No. 1586, 1822?
[*Bombyx argus*] Donovan, Naturalists' Repository, V, p. 173, 1826.
Saturnia (Eudaemonia) argus Westwood, Edit. Drury, Illust., III, 39, Pl. 39, fig. 1, 1837; Proc. Zool. Soc. London, 1849, p. 49.
Eudaemonia argus Walker, Cat. Lep. Het. Brit. Mus., V, p. 1266, 1855.
Eudaemonia brachyura Rothschild, Nov. Zool., II, p. 47, 1895; Beutenmüller, Jn. N. Y. Ent. Soc., IX (1901), p. 195 (larval habits).

Imago.—Two ♂, two ♀. Head, body, and wings of a soft delicate flesh or salmon reddish pink. Antennæ black-brown. Fore wings adorned with a group of from one to five or six little round ocelli, which are transparent in the center, where there is but a single one, it is the discal spot on the outside of the upper discal vein, which is broadly lunate, faded ochre and ringed with brown, only half the width of the discal area, or it may be double like the figure 8,

the two extending across the discal space; in one ♀ there are eight circlets, one small one beyond the discal ones and one inside of it in the discal cell and one in each of the next cells behind. Extradiscal line broad, diffuse, curved at nearly a right angle before reaching the costa. Hind wings concolorous with the fore wings, with four or five round spots, larger and more distinct, and with a darker circle than those on the fore wings. There is one in the discal cell, two beyond, and two near the inner edge. Fringe silky, pale yellow ochre on the wings of both pairs. A faint straight extradiscal line.

The tails are very long and narrow, almost linear, from three to five times as long as the wing itself, and widening on the outer third or fourth, and twisted. End of ♀ abdomen very full, rounded, and dark buff brown.

Expanse of fore wings, ♂ 54 mm.; ♀ 54 mm.
Length of fore wing, ♂ 30 mm.; ♀ 29 mm.
Breadth of fore wing, ♂ 17 mm.; ♀ 15 mm.
Length of hind wing, ♂ 120 mm.; less the tail 19 mm.; in ♀ 70 mm.
Breadth of hind wing, ♂ 18 mm.; ♀ 16 mm.
Width of tail in middle, 1.5 mm.; greatest width near the end, 3 mm.

It differs from *E. argiphontes* in its pale salmon color. The number of ocelli is exposed to very considerable variation; in one ♂ there are three ocelli on the fore wing and three on the hind wing, those on the hind wing being situated in a row nearly parallel with the inner edge of the wing.

"*E. brachyura* (Drury) at Sierra Leone is very constant, of a buffy rose tint, and about 3 inches to 3½ inches across the fore wings. Round Cape Coast Castle, on the other hand, the males very seldom expand more than 2½ inches, have very long tails, and vary in tint from ashy gray to bright yellow and salmon rose. This race may prove distinct enough to be named, but of my five specimens no two are alike, so I prefer not to describe it at present. I must add that, although taken from the type specimen, all three figures of *E. argiphontes* Kirby are very different, and all unlike the insect." (Rothschild, Nov. Zool., p. 47.)

Geographical distribution.—"Sierre Leone" (Mr. Smeathman); Island of Banana (Smeathman, fide Westwood and Stoll), Ashanti (Brit. Museum, Walker). Duplicates received from the British Museum and compared with the specimens in that collection.

The single larva loaned me by the American Museum of Natural History from the shape of its spines and its size had evidently not attained its final stage; and it is fortunate that this is so, as it gives us an idea of its life history and affinities.

Larva.—Stage before the last: Head large, roundish, about as wide as the prothorax; with groups of microscopic granulations; in color deep reddish amber or honey-yellow, as is the prothoracic collar. Body cylindrical, very densely armed with long, stout spinulated spines, arranged in eight thoracic and six abdominal rows (eighth segment with only five), as in *E. argiphontes;* but the tubercles are longer, higher, and sharper than in the final stage of *E. argiphontes.* Prothoracic plate large, somewhat crescentiform, armed on the front edge above with four stout pale spines, the two inner ones small, not so long as the others, but simple, ending in a single stout sharp, spike-like spine, with four or five small setiferous spinules along the base; the two others nearly twice as thick and ending in three diverging spikes; below are eight or nine smaller setiferous spines.

The second and third thoracic and the abdominal spines are very large, erect, long, and stoutly spiked, those of the second and third thoracic segments ending in four to five spines, two or three of which are terminal and no larger than those of the supraspiracular lateral row; those of the infraspiracular row nearly as large; those of the lowest lateral row situated directly over the legs are quite large, spiny, and end in two stout spikes.

The tubercles of the abdominal segments are of the same height or length as the thoracic ones, the differentiation which takes place at the last molt not yet having been effected so that the abdominal dorsal spines are of the same size and appearance as the thoracic ones, though the former (abdominal) have a terminal spike less, only two in all.

The median spine on the eighth abdominal segment is stouter than the others, wider, ending in four spikes, two on each side. All the tubercles are dark honey-yellow and similarly armed, having besides the large terminal spikes; along the shaft numerous stout setiferous spinules.

Suranal plate large, broad, the surface minutely granulated, with a few setiferous ones; the edge thickened and posteriorly armed with numerous fine sharp setiferous spinules, while the two large spinulated tubercles are as described for the last stage. Over the base of each abdominal leg (1–4) is a small single spine. Anal legs subtriangular, surface sparsely pitted and with setiferous granulations.

The body is black above, mottled on the side with yellowish, the suranal plate and anal legs honey-yellow; under side of the body pale.

Length, 25 mm.

The larva in this stage, most probably the one before the last, and more generalized than in the last stage, is interesting as showing the equality in size and appearance of all the dorsal spines, both thoracic and abdominal. The spines also are longer in proportion than in the final stage of *E. argiphontes*. The more generalized nature of the young larva is paralleled by what one knows of the larval history of the Saturniidae. Unfortunately we do not yet know the larval history or earlier larval stages of any of the Protosphingina except the Citheroniinae; but the indications are that the armature of the first stage of *Eudaemonia* is quite unlike that of this last-named subfamily, but that they are hatched with spinose tubercles on all the segments, as in the Hemileucidae and Saturniidae.

[The larvæ feed gregariously on *Dialium guineense* Willd. (Leguminosae).]

Pupa.— ♂. It does not differ, except in being a little smaller, from that of the other species; the setæ, however, are more numerous and finer, especially at the end of the abdomen; the four tufts of fine bristles on the under side of the abdomen are shorter and smaller; length, 22 mm.

The pupæ [examined] of both species are of the same sex.

EUDAEMONIA ARGIPHONTES W. F. Kirby.

Plate XXXI, fig. 10; LXXIII, fig. 1, 2.

[*Eudaemonia argiphontes* Kirby, Trans. Ent. Soc. Lond., 1877, p. 20.]

Imago.— ♂. Antenna same length as in *E. brachyura*, with longer pectinations than in *E. brachyura*, only distal pair present; ♀ antenna with pectinations a little longer than those in ♀ *brachyura*.

Palpi much shorter and stouter than in *brachyura*, third joint in ♂ not so long as second joint is wide, about one-half as wide. Third joint in ♀ much longer than width of second, nearly as long as in ♀ *brachyura*. (Such a discrepancy in palpi of sexes never seen before.)

Body fawn-brown, uniform; fore wings lilac at base and along costa and costal end of outer line; basal line dark, distinct, oblique, lilac externally; extradiscal line straight, not sinuous, not recurved on costa (as in *brachyura*); four to seven clear spots in a row, including the extradiscal one, and two small clear dots farther inward toward center of wing. (In three males the two inner spots on fore wing wanting, well developed in ♀.)

Hind wing as in *brachyura*, but more scalloped, six clear spots in two rows; one dark brown extradiscal line and traces of basal line; tails dark on edge, along middle deep scarlet. Beneath tails and wings uniform fawn brown; ♀ body and wings a little larger, antennæ as in *brachyura*, scarcely shorter, tails much shorter; five clear spots on hind wing; general color a little more fawn, less dusky, both wings perhaps a little more scalloped, clear spots on fore wings larger than in ♂.

Expanse of fore wing, ♂ 62 mm.; ♀ 63 mm.
Length of fore wing, ♂ 32 mm.; ♀ 33½ mm.
Breadth of fore wing, ♂ 18 mm.; ♀ 20 mm.
Hind wings [♂], length 123, including tail, breadth 13 mm.; tail alone 103; breadth of tail in middle 1½ mm.; ♀ hind wing 86, tail 67, breadth 1½ mm.

In one male, body and wings are darker than in the two others, more umber or vandyke brown, and the four (only) spots on fore wing tend to become obsolete, smaller and almost wholly opaque with brown scales.

(In *brachyura* the spots vary in size, in one ♂ on fore wing they are one-half as large as in another ♂ and opaque, with a minute central clear dot.)

Geographical distribution.—Sierra Leone, Africa. (D. Cator.)

Larva.—The last stage. Body rather thick, not tapering behind, cylindrical. Head rather large, not much narrower than the prothoracic segment and slightly more than half as wide as the body in its thickest part; surface of the head with groups of microscopic granulations, about four to eight in a group, except on the clypeal region and near the eyes, where the surface is smooth. The body heavily armed with six rows of large stiff spinulated tubercles. On the three thoracic segments an additional row on each side. On the prothoracic plate the four dorsal tubercles are shorter than the others, and the two on each side of the median line are close together. The inner two on each side of the median line of the body form two stout acute diverging spike-like spines, with five or six smaller ones around the base; those of the outer row are composed of four larger radiating spines, with four to five smaller setiferous ones around the base. On each side of these two sets of tubercles are the two lateral spines, one supraspiracular, the other infraspiracular; the former is large, thick, and high, fleshy at the base, and bearing above about a dozen stout acute spines, the smaller ones ending in a stiff seta.

The second and third and the abdominal segments heavily armed with stout spiniferous tubercles, which are fleshy at base, and chitinized toward the end. The two rows of dorsal ones on the second and third thoracic segments and the median tubercle on the eighth abdominal segment are distinctly larger than the other abdominal ones and dark in color, while the abdominal tubercles (four dorsal rows) are pale (in alcoholic specimens).

They are clavate, enlarging a little at the end, and terminating in two diverging, large, stout, spike-like spines, while the shaft of the tubercle bears from about 8 to 10 smaller spines, varying in size, one or two of them nearly as large as the two uppermost ones. All of the spines, both of the dorsal and lateral rows, are of the same general shape, those on the sides but little smaller, and those on the back of the abdominal segments a little smaller than the thoracic ones, and slightly longer than those on the sides of the same segment.

The median tubercle on the eighth abdominal segment is somewhat larger than the one on each side of it, and shows its double origin by the evident fusion of two primitively separate ones, by its greater thickness, width and the bilateral arrangement of the spines; of the four uppermost and larger ones, two on each side diverge from the two on the other side.

There are six tubercles on the ninth abdominal segment, the lowest one on the side of the segment forming a single curved spine, ending in a stout seta.

Suranal plate (tenth abdominal segment) large, broad and rounded behind, the surface granulated, the edge much thickened, and on the extreme hinder edge armed with several minute setiferous spines on each side. Beyond the middle of the plate on each side, at the edge, is a large stout spinulated tubercle as thick as, but not quite so long as the supraspiracular one on the ninth abdominal segment; it is armed with about eight large unequal acute stout spines, and numerous smaller setiferous ones. The two large erect spines are one of the diagnostic features of the group.

Anal legs large, subtriangular, the surface sparsely pitted and finely granulated; the hinder edge finely spinulated, the spinules ending each in a seta.

In the alcoholic example the head is colored chestnut brown. On the sides of the body is an irregular network of dark blotches, sending irregular lines or blotches up on each side of the spinules. The thoracic legs are pale reddish chestnut; the abdominal legs pale, with a chitinous dusky spot on the outside near the middle of the leg.

Length 35 mm.

Pupa.— ♂. A very singluar pupa, nothing like it occurring, so far as we know, in any of of the Saturnian or protosphingoid families, or indeed in any other Lepidoptera.

Body somewhat flattened from above downward, the head and end of the abdomen being inclined downward.

Antennæ broad and distinct, not transversely ribbed on the side of the pectinations as usual in all Lepidoptera, but armed with nearly parallel rows of scraggly, irregular, uneven, erect, slender spine-like minute setæ, the rows irregular and with scattered hairs between them. The eyes oval, pointed at each end, surface rough, and on the inside roughened with a dense hedge of bristly erect irregular slender spinules. Between these two hedges are, near the vertex, two groups of similar spines of uneven length; they extend to the ocular hedge, but between them is a smooth valley.

The pupa differs from any other known to me in there being no indications of the limbs and mouth-parts, the result of a process of specialization in a direction hitherto unknown to me. Over the site of the interantennal region of the appendages is a broad rough surface, on which are no traces of the labrum, maxillæ or maxillary palpi, as are to be seen in other pupæ, as those of *Eacles*, etc., but the surface is roughened, not divided into areas, and with scattered groups of erect scraggly hair-like setæ. By scraping away the crust of the hardened exudation thrown out at the time of pupation, the indications of the legs can be seen beneath.

The proportions of this interantennal area are as in *Eacles*, but shorter. The pupa of *Eacles* is also on the under side of the head and thorax roughened with scattered groups of fine flattened tubercles, and the surface of the pupal eyes is rough, but in *Eudaemonia* the little rough eminences of *Eacles* are exaggerated and thrown up into erect scraggling setæ.

The abdomen is somewhat flattened, with numerous irregularly scattered minute groups of spinules. On the under side are four large elongated groups of high setæ, two on second, and two on the third segment of the abdomen.

The shape and armature of the end of the abdomen is unique, the end being tridentate; what appears to be the cremaster being a median flattened tooth, broad at the end and covered with long stiff hairs, lying as if fastened to the surface, and directed backward; the end is entire, not forked; on each side, seen from beneath, is a flat, broad, sharp tooth bearing long setæ glued to the surface.

The tergal sides of abdominal segments 9 and 10 are fused into a single piece, the surface and sides of which are rough, spinose, like the rest of the abodmen, but behind the suture dividing this terminal section from the rest of the abdomen are two rather large deep rounded pits, with the edges smooth and polished and separated by a similarly polished rounded saddle or bridge. The lateral flattened projections on each side of the cremaster are, seen from above, sharp triangular processes with a mucronate tip. Length 28 mm.

Family HEMILEUCIDÆ.

[Dr. Packard's account of the family characters existed only in the form of rough notes, parts of which can not now be interpreted.]

VIEW OF HEMILEUCIDÆ.

14. Meroleuca.
Pseudohazis.
13. Hemileuca (+Euleucophaeus).
12. Coloradia.
11. Automeris — 16. Pseudaphelia. 15. Heliconisa.
10. Gamelia.
9. Hyperchiria.
8. Protautomeris (maeonia).
7. Hyperdirphia (tarquinia). Hylesia.
6. Phricodia (agis, hircia).
5. Dirphia (semirosea, speciosa, hoegei).
4. Ormiscodes (cinnamomea).
3. Rhodormiscodes (rosea).
2. Catocephala (alanus and luperina).
1. Molippa (sabina).

[Hylesia and Pseudohazis were not numbered.]

FAMILY CHARACTERS.

Imago.—Head not prominent, of moderate size; front shorter than in Saturniidæ, and a little wider; squamation shaggy, hairs in front rather long and irregular, and converging to a blunt point in front; eyes of moderate size, in some genera (*Hemileuca*) rather small. Antennæ of male characteristic in shape, usually pectinated to tip, pectinations slender and long, giving a subplumose appearance; the antennæ rarely (*Rhodormiscodes*) subfiliform at extreme tip; joints usually short, the basal pectinations long and slender and inclined to be curved downward toward the end; distal pectinations varying in length and size, but usually half to three-fourths as long as the basal ones; in *Hemileuca maia, H. juno, Heliconisa* and *Pseudaphelia* no distal pectinations. Antennæ of female either simple (*Automeris*), subsimple (*Molippa*), denticulate (*Dirphia* and *Catocephala*) or with short pectinations (*Hemileuca* subg. *Euleucophaeus*) or longer (*Hemileuca maia* and *juno*), so that the female antennæ become nearly half as wide as those of male, though the tips are subfiliform.

Palpi 3-jointed, rather short, weak, not usually reaching the front, only in *Dirphia* reaching to the front so as to be seen from above; third joint either short and not visible (concealed by hairs of second), or visible but depressed; squamation loose, making them look bushy.

Thorax rather large and shaggy, the hairs irregular, so that the prothorax and tegulæ are not distinct; in *Dirphia* and *Ormiscodes* these longer hairs are singularly modified, flattened, slender, paddle-shaped, black and light.

Legs with the femora very hairy; tibiæ and tarsi usually thick; a tibial saclike appendage in male *Heliconisa*, slender, about three-quarters as long as the tibia, but not yet detected in other genera; in *Pseudaphelia* a large brown naked sac as long as, and wider than, the fore tibia, arising at base. In *Hylesia* the entire fore leg to subtarsal joint is very hairy.

Fore wings short and broad, triangular or narrower, about twice as long as broad; costa nearly straight, and either arched or (*Hemileuca*) slightly concave; fore wings either not falcate (*Catocephala, Dirphia, Ormiscodes*), or subfalcate (*Molippa, Automeris, Heliconisa*), or decidedly falcate (*Hylesia*).[1] Hind wings broad and rather large (*Dirphia*) or subtriangular (*Hylesia*); either not reaching to end of abdomen (*Catocephala*) or reaching to end (*Automeris*) or extending beyond (*Dirphia*).

Venation [no description].

Markings: Ocellus in fore wing, none in more generalized genera (*Molippa, Dirphia*), a small discal spot (*Catocephala, Ormiscodes*), diffuse and indistinct (*Rhodormiscodes, Hylesia, Automeris*), a round spot inclosing a reniform or crecentiform mark (*Hemileuca*) or none at all (*H.* [*Meroleuca*] *venosa*). It appears on under side in *Automeris*. [In male *A. io* the large round black spot on under side has a white pupil, which is often bright and very distinct.] On the hind wing there is no ocellus except in *Automeris*, and a slight one in *Hemileuca maia* [and other species of *Hemileuca*].

Abdomen large and full, variegated, beautifully banded in *Molippa* and *Dirphia*, and with long scattered hairs.

Larva.—Head round, body cylindrical; anal legs of moderate size, smaller than in Sphingicampidæ and Saturniidæ, being more generalized. Body not provided with high tubercles giving rise to spines, but the spines are long and slender, branched in *Dirphia* and *Automeris*, and arise from a slight eminence on the skin.

The eighth abdominal segment bears a *median tuft*, larger than those on each side, and there are no generalized types (showing two separate ones). *All have the lateral eversible sacs*, a family character.

There are two series of larval forms:

(1) *Dirphia* to *Automeris:* With single long slender branched spines as in *Dirphia*, varying in *Automeris;* with single and unbranched, or with branches (*A. nyctinene* from Brazil), or high and much branched (*A. pamina*), or shorter and closer (*A. io*).

(2) With smaller shorter collections of separate spines forming fascicles, as in *Hemileuca, Coloradia* and *Pseudohazis;* the latter group appearing more specialized.

[1] [Strongly falcate in male of *Automeris auletes* (Herrich-Schaeffer)].

SUBFAMILIES.[1]

(1) Characters of family [see above]..... *Hemileucinæ.*
(2) Body small, abdomen short; hind wings large, vein II of fore wing not present; two distal ocelli; antennæ plumose, no distal pectinations..... *Pseudapheliinæ.*

MOLIPPA Walker.

[*Molippa* Walker, Cat. Lep. Het. Brit. Mus., VI (1855), p. 1345.]
[The type is *M. sabina* Walker.]

Imago.— ♂, ♀. Head with the front moderately wide; eyes moderately large. Antennæ of male much as in *Dirphia,* but a little shorter; joints moderately long; the pectinations as in *Dirphia;* two pairs of pectinations to each joint, those of the distal pair shorter and situated close to the basal ones, as in *Dirphia;* ♀ antennæ nearly simple; the joints about as long as thick, the pectinations being represented by a group of about three setæ on each side. Palpi well developed, rather stout and blunt at the tips, porrect, extending out beyond the front, being larger and more distinctly visible than in *Dirphia.*

Thorax moderately thick, as in *Dirphia,* hirsute above, with darker, thick set long hairs.

Fore wings longer, narrower, and more pointed in ♂ and ♀ than in any species of *Dirphia* known to me; subfalcate, costal edge considerably curved and the outer edge more oblique than in *Dirphia.* Hind wings rounded, rather more so than in *Dirphia,* outer edge full and convex; they reach end of abdomen.

Abdomen distinctly banded with black and yellow ochre.

Markings much as in some species of *Dirphia.* There is no distinct discal mark, but a large irregular dark scalloped loose ring, and on the hind wings a somewhat oblong dark smoky discoloration. The extradiscal line scalloped; the basal one obscure; there are two smoky black lines on the hind wings.

This genus differs from *Dirphia* in having larger and somewhat longer palpi, shorter antennæ, while the fore wings are longer, narrower, and more pointed. In *Dirphia* there is either a small white discal spot or none at all, while in the present genus there is an irregular discal ring. There are no vestiges of pectinations on the ♀ antennæ, their place being taken by a group of cilia, a rather rare feature in this family.

MOLIPPA SABINA Walker.

Plate XLII, fig. 6.

[*Molippa sabina* Walker, Cat. Lep. Het. Brit. Mus., VI (1855), p. 1345.]

Imago.—Two ♂, one ♀. Head, thorax, and wings ashy fulvous or tawny, with a generally faded hue. Thorax with scattered long black subclavate hairs, which are more numerous in ♀ than ♂.

Fore wings with a broad diffuse longitudinal shade at base behind the costal region, extending out to the submarginal line. Traces of three basal lines on the costal edge. Discal spot a large smoky brown irregular ring forming three scallops on the outer edge, the points or apices of the scallops resting on the veins; a median line within the ring extends along the discal veins. Extradiscal line double, dark, regularly scalloped, beginning on the outer one-fourth of the inner edge and ending on the outer one-fifth of the costa, next to a subapical distinct dark brown costal patch, which on the costa extends nearly to the apex. An obscure irregularly scalloped submarginal line, beyond which the edge of the wing is dull, but uniformly tawny. Fringe on both wings short, white at the ends of the veins, black between. Hind wings clearer and paler on the inner two-thirds, discal spot narrow long, blackish. A distinct extradiscal smoky black line, and beyond is another about twice as wide, scalloped on the outer edge; beyond this line the outer edge is dusky tawny, while the veins are ochre yellow. Wings beneath uniformly paler than above, and with the markings less distinct and the discal rings obsolete. At the base of the fore wings is a black patch which extends to the eyes.

Abdomen with distinct black and orange-ochreous rings of the same width, with a few long scattered pale hairs arising from the orange bands or rings.

[1] [See also *Holocerinæ,* p. 144.]

Legs black; femora tawny, of the same hue as the under side of the body.

Expanse of fore wing, ♂ 80 mm.; ♀ 90 mm.
Length of fore wing, ♂ 41 mm.; ♀ 50 mm.
Breadth of fore wing, ♂ 20 mm.; ♀ 25 mm.
Length of hind wings, ♂ 28 mm.; ♀ 33 mm.
Breadth of hind wing, ♂ 20 mm.; ♀ 26 mm.

This moth differs from any species of *Dirphia* known to me in its faded-out tawny hue, the larger irregular discal ring, and the two parallel extradiscal dark lines; also in the more acute apex of the fore wings.

CATOCEPHALA Blanchard.

Catocephala Blanchard in Gay, Faun. Chil., VII, p. 62, 1852, Lam. 6, fig. 1, 1854.

Imago.— ♂ and ♀. Head much as in *Ormiscodes* (*O. cinnamomea*), with a rather narrow front; eyes rather large. Antennæ of male longer than in *Molippa* or *Rhodormiscodes*, and slightly longer than in *Ormiscodes;* not so broadly pectinated as in *Rhodormiscodes;* only the extreme tip subfiliform; joints moderately long; basal pectinations slender; distal pectinations slender, the outside ones two-thirds as long as the basal pectinations; the inner ones a little shorter, being much longer than in *Dirphia hoegei* and a little longer than in *Ormiscodes cinnamomea;* in ♀ subfiliform, the pectinations vestigial, toothlike, ending in two hairs; vestiges of the distal pectinations minute and with no hairs. Palpi much as in *Ormiscodes* (*O. cinnamomea*), extending beyond the front, but drooping, terminal scales long, irregular, and third joint not distinct, being concealed by the scales projecting from the end of the second joint.

Thorax shaggy, rough, with numerous irregular long flattened paddle-like hairs, either acute or oval at the end.

Fore wings much as in *Ormiscodes* (*O. cinnamomea*), not so long as in *Molippa*, not falcate, apex not produced, but rather square, outer edge very slightly falcate (*C. alanus*) or not at all so (*C. rufosignata*).

Hind wings more produced at the apex than in *Ormiscodes* (*O. cinnamomea*) or in any other genus of the group known to me, especially marked in the ♀. They do not reach to the end of the abdomen, being shorter than in *Ormiscodes* and much shorter than in any other genus of the group.

Markings: Body and wings reddish brown or gray and pale ochreous. A small white ochreous oval or linear oval discal spot on the fore wings, none on the hind wings. An extradiscal line common to the wings of both pairs. A basal line, and on the hind wings two subparallel lines, the outer situated about halfway between the outer edge and the extradiscal line. The females are much alike, the males more divergent in coloration.

This genus is intermediate between *Molippa* and *Dirphia*, and on the whole most nearly allied to *Ormiscodes* (*O. cinnamomea*).

Geographical distribution.—The species are confined to Chile, or at all events to the west coast of South America.

[*C. amphinome* (Fabr.) occurs in Tierra del Fuego.]

SYNOPSIS OF THE SPECIES.

Reddish brown; lines not scalloped; discal spot small; abdomen not banded ..... *C. alanus.*
Gray; lines scalloped; discal spot large; abdomen yellow, banded with black ..... *C. rufosignata.*

CATOCEPHALA RUFOSIGNATA Blanchard.

Catocephala rufosignata Blanchard in Gay, Faun., Chil., VII, p. 63, 1852, Lam 6, fig. 1, 1854. [According to Kirby this is the type of the genus.]

Imago.—One ♂, one ♀. Body and wings gray, with a tawny ground color in ♂ and a roseate tinge in ♀. Head and antennæ tawny. Palpi distinct, depressed, extending beyond the front of the head, black.

Fore wings short and broad, costa nearly straight, more incurved in ♀, whitish gray on a tawny ground. Basal line black, distinct, arising from a large black oblong costal spot on the inner third of the wing, and ending near the middle of the inner edge; the line makes a small angle on vein III. Discal spot distinct, white, narrow, either straight or slightly curved and situated midway between the basal and extrabasal line; the latter a zigzag white narrow line edged externally with dark brown, ending on the costa in a black conspicuous mark. Beyond this line the wing is clear tawny, but darker on the outer edge of the wing beyond the irregular zigzag edge of the tawny region, the outer edge being coppery red-brown in ♀. Veins black in ♂, not so dark in the ♀, except toward the edge of the wing.

Hind wings of ♂ of the same hue, being pale tawny as in *Molippa sabina*, no discal spot, and with two outer scalloped lines, the outer of the two lines more diffuse. Ends of the veins on the outer edge black. In ♀ the wings are darker and reddish brown, especially on the outer third.

Beneath only faint traces of the discal spots, and no lines. Margin of the wing of ♂ spotted with black, uniformly pale tawny; in the ♀ there are more decided traces, especially on the veins of the extradiscal line, but the general hue is a pale faded purplish reddish brown.

Thorax tawny and black, mixed with longer pale clavate hairs of different lengths. Abdomen extending well beyond the hind wings, of a Scotch snuff yellow color, with broad black rings; the extremity yellow ocher.

Expanse of fore wings, ♂ 55 mm.; ♀ 66 mm.
Length of fore wings, ♂ 30 mm.; ♀ 34 mm.
Breadth of fore wings, ♂ 15 mm.; ♀ 18 mm.

The discal spot larger than in any other species of the group known to me.

CATOCEPHALA ALANUS Blanchard.

Plate LIII, fig. 3 (*Dirphia alanus*).

Catocephala alanus Blanchard in Gay, Hist. [I fail to trace any publication of this species. It is not in Kirby's Catalogue. Mr. Samuel Henshaw has kindly looked in Gay's Fauna Chilena, and reports that *C. socialis* and *C. rufosignata* are the only species of the genus mentioned in that work; both on p. 63 of Vol. VII.]

Imago.—One ♂, one ♀. Uniformly reddish or brick-red brown. The back part of the thorax and the abdomen on the sides and beneath dull reddish ocherous. Long black paddle-shaped hairs arise from front of the thorax.

Fore wings very slightly subfalcate, outer edge very slightly excavated, while that of *C. rufosignata* is not so. Wings with a frosting, tinged with lilac on the outer margin and at base. A dark brown basal line situated nearer the discal spot than the base of the wing. Discal spot small, oval, narrow, white. Extradiscal line narrower than the basal line, not scalloped, slightly curved outward opposite the discal area.

The hind wings with no discal spots, slightly paler and clearer than the fore wings. Extradiscal line rather broad and diffuse and bent outward opposite the discal area; a second submarginal line. Wings beneath a little paler and clearer than above and the extradiscal lines are faintly reproduced. On the hind wings is a broad reddish clear shade on the outer fourth of the wing, corresponding to the space between the two lines on the upper side. Abdomen dull ocherous at base above, beyond black brown, not ringed or banded, and on the sides and end and beneath dull ocherous.

Expanse of fore wings, ♂ 72 mm.; ♀ 87 mm.
Length of fore wings, ♂ 37 mm.; ♀ 45 mm.
Breadth of fore wings, ♂ 21 mm.; ♀ 22 mm.
Length of hind wing, ♂ 30 mm.; ♀ 32 mm.
Breadth of hind wing, ♂ 20 mm.; ♀ 20 mm.

This species very different in color and markings from *C. rufosignata*, the lines not being scalloped and the wings more uniformly clear and plain, and it is a larger species, but structurally the two species are congeneic.

Geographical distribution.—Chile (from Franck).

CATOCEPHALA LUPERINA.

Plate LIII, fig. 10.

RHODORMISCODES Packard.

Rhodormiscodes Packard, Journ. N. Y. Ent. Soc., XI (1903), p. 244.

Imago.— ♂. Front of the head a little broader than in *Ormiscodes.* Antennæ shorter and wider than in that genus; as usual pectinated to the tip, the extremity of which is subfiliform; antennæ joints shorter than in *Ormiscodes.* Two pairs of pectinations, the distal pair larger than in *Ormiscodes,* those on the inner side only slightly shorter than those on the outer side. Palpi ascending and projecting beyond the front, much larger, longer and wider, with shorter, closer squamation than in *Ormiscodes;* third joint distinct, about one-half as long as second joint is wide, while in *Ormiscodes* they are depressed, small, short, and indistinct and with irregular scales.

Thorax with scattered, long, flattened hairs, as in *Ormiscodes.* Fore wings more falcate than in *Ormiscodes,* costa fuller, more convex toward apex; outer edge short; wings subfalcate, but not excavated behind the apex. Hind wings regularly rounded on the apex and inner angle, much more so than in *Ormiscodes,* and of quite different shape from that genus.

Venation: Vein II_1 [III_1 of revised nomenclature] arises near the outer end of the discal cell, i. e., much nearer the origin of the anterior discal vein, and the two discal veins make a straight line, not an oblique one as in *Ormiscodes cinnamomea,* and they are situated inside of the middle of the wing. On the hind wing veins II_1, II_2, II_3, arise farther apart than in *O. cinnamomea.*

Markings: No white discal spot, but an irregular dark one. Purple tints with purple-brown markings, and roseate hind wings. The abdomen is banded with yellow and black.

This genus is based on *Ormiscodes rosea* Druce.

Geographical distribution.—Vera Cruz, Mexico.

This genus differs from *Ormiscodes* not only in the venation, but in the larger palpi, the shorter, broader antennæ, subfalcate fore wings and more rounded hind wings. The thorax is equally shaggy and wooly and the legs thick and hairy. In the shape of the fore wings and absence of a discal spot it somewhat approaches *Hylesia.*

RHODORMISCODES ROSEA (Druce).

Plate LIII, fig. 5.

Ormiscodes rosea Druce [Biol. Cent. Amer., Lep. Het., I (1886), p. 195, pl. 20, f. 7, 8].
Ormiscodes rosea Kirby, Syn. Cat. Lep. Het., I, p. [790].

Imago.—One ♂. Front of head rather wide. Palpi unusually large, broad and stout, with short hairs, extending well beyond the front; third joint not so long as the second is wide. Antennæ pale, not so long as in *O. cinnamomea,* but of the same hue. Thorax dark brown, with longer irregular dark hairs.

Fore wings short, moderately broad, costa well curved on the outer third; apex much more rounded than in *O. cinnamomea.* Both pairs of wings purplish brown; no definite basal line, but the middle of the wing is occupied by a V-shaped rose-lilac area, the apex of the V resting on the inner edge just beyond the middle of the wing, and the two arms ending, the inner on the inner fourth and the outer on the outer fourth of the costal edge, and inclosing the large brown narrow irregularly triangular discal spot. The outer arm of the lilac V is bent inward on the costa, and beyond this bend is a large dark costal brown spot extending to the apex. No definite line beyond the extradiscal. Fringe on both wings brown, white at the ends of the veins.

Hind wings deep roseate on the basal half. An oblique obscure dark diffuse discal discoloration extending to the extradiscal line; a broad heavy diffuse dark brown line, curved opposite the discal spot. Between this and the edge of the wing is a broad obscure dark band. Margin of wing clear roseate brown.

Beneath both wings roseate brown, somewhat faded in hue; traces of a discal spot on the fore wings, none on the hind wings, but the extradiscal dark line is common to both wings. Legs reddish brown; no black hairs; tibiae and tarsi deep reddish rose. Abdomen deep yellow ochre, with four black dorsal bands, tip reddish-ochreous.

Expanse of fore wings, ♂ 50 mm.
Length of fore wings, ♂ 26 mm.
Breadth of fore wings, ♂ 14 mm.
Length of hind wings, ♂ 20 mm.
Breadth of hind wings, ♂ 14 mm.

A very pretty species, which may be recognized by the rosy basal half of the hind wings, the lilac hues, and the V-shaped lilac mark.

Geographical distribution.—Vera Cruz, Mexico (Franck).

ORMISCODES [Blanchard].

[*Bombyx*] Feisthamel, Voyage de la Favorite, Mag. de Zool., 2e série, pl. 22, fig. 2, 1839.
Ormiscodes Blanchard, in Gay's Historia fisica y politica de Chile, Zoologia, VII, p. 61, 1852.
Ormiscodes Kirby, Syn. Cat. Lep. Het. [I, p. 789].

[The type, according to Kirby, is *O. cinnamomea* Feist.]

Imago.— ♂. Front of the head moderately broad. Antennæ moderately long; joints quite long and slender, pectinated to the tip, the distal pectinations very slender, those on the outside about three-fourths as long as the basal ones, those on the inside a little shorter. Palpi moderately stout, third joint visible, but the terminal scales are irregular, not dense as in *Rhodormiscodes*. Thorax thick, shaggy, with long irregular black paddle-shaped scales. Abdomen extending well beyond the hind wings, and with irregular paler hair-like scales, longer than the normal vestiture.

Fore wings not subfalcate, costa straight; apex subacute; outer edge not full, straight, and with no tendency to be hollowed out.

Hind wings rather square at the apex; outer edge moderately full, not regularly rounded, being most convex toward the end of vein II_3.

Legs stout and hairy. Abdomen rather long.

The genus may be known by the fore wings not being even subfalcate, the costa being straight, and the hind wings rather square at the apex. The palpi are moderately stout, the scales of uneven length, and the third joint visible.

Geographical distribution.—West coast of South America; from Chile.

[Species assigned to *Ormiscodes* have been described from Central America and Brazil, as *O. amarilla* Schaus (Costa Rica), and the Brazilian *O. albilinea* Schaus, *O. fornax* Druce, *O. delta* Foetterle, *O. irregularis* Foetterle, and *O. ayurusca* Foetterle; the last three beautifully figured in colors in Rev. Mus. Paulista, V.]

ORMISCODES CINNAMOMEA Feisthamel.

Plate LIII, fig. 6.

Ormiscodes cinnamomea Feisthamel, Voyage de la Favorite, Mag. de Zool., 2d série, pl. 22, fig. 2.
Ormiscodes cinnamomea Blanchard in Gay's Historia fisica y politica de Chile, Zoologia, VII, p. 61, 1852, pl. 4, 1854.
Ormiscodes cinnamomea Kirby, Syn. Cat. Lep. Het., I, p. [790].
Ormiscodes crinita Blanchard [t. c. pl. 4, f. 4].

Imago.—One ♂. Body, antennæ, and wings pale ochreous; head and under side of thorax and abdomen dull ochreous or snuff color. Thorax rough and shaggy with longer black lanceolate oval or paddle shaped scales projecting upward from in front, the thorax behind being more ochreous.

Wings pale ochreous, washed with white scales. Basal line a little nearer the discal spot than the thorax, zigzag with three scallops, ending behind near the middle of the inner edge. A conspicuous white irregularly lunate discal spot, with a minute white dot in front at the origin of vein II^4. Extradiscal line straight, not zigzag, deep ochreous, with white scales inside of it, and situated a little nearer the discal spot than the outer edge of the wing. A short oblique

whitish apical streak, which faintly connects with an obscure scalloped line, becoming more distinct on the hinder half of the wing.

Hind wings paler than the anterior ones, and with no discal spot. There are two outer lines, obscure, diffuse, the inner one curved outward opposite the discal area; edge of the wing darker ochreous.

Wings beneath showing no discal spots and no lines; the outer margin of both pairs of wings ochreous, the wings within paler.

Abdomen black above, the tip ochreous as is the under side, tibiae and tarsi dark brown.

Expanse of fore wings, ♂ 65 mm.
Length of one fore wing, ♂ 33 mm.
Breadth of one fore wing, ♂ 12 mm.
Length of hind wing, ♂ 25 mm.
Breadth of hind wing, ♂ 13 mm.

Geographical distribution.—Western coast of South America; Chile.

DIRPHIA Hübner.

[*Dirphia* HÜBNER, Verz. bek. Schmett., p. 153 (1822?).]

[Dr. Dyar writes that Hübner included four names under *Dirphia: tarqinius, acidalia, speciosa,* and *agis.* According to Kirby's Catalogue the first two are one species, *D. tarquinia* Cramer, which he designated as the type of *Dirphia.* Kirby refers *speciosa* to *Plateia,* and *agis* to *Phricodia.*]

[*Dirphia*] KIRBY, Syn. Cat. Lep. Het., I [p. 793].

Imago.— ♂ and ♀. Head, front rather narrow, with long scales; eyes moderately, fairly large. Antennæ of male rather short and broad, a little wider and shorter than in *Ormiscodes;* pectinated to the tip; joints (in *D. hoegei*) short, thick, and well ciliated; the distal pectinations are dorsal, arising from the upper side, and the inner ones are short, not quite one-half as long as the basal ones, the outer set are shorter than the inner by a third of the length of the outer ones. Female antennæ subsimple (*D. hoegei* and *semirosea*), joints on the basal half wider than long; basal pectinations large, dentiform, ending in two unequal bristles, in ♀ *D. speciosa* the teeth (basal pectinations) are smaller, and there are minute vestiges of the distal pectinations.

Palpi much as in *Ormiscodes,* being rather thick and short, reaching a little beyond the front; third joint usually not very distinct, depressed. No vestiges of the maxillæ are visible in the undenuded example.

Thorax rough and shaggy, with numerous long, erect, paddle-shaped scales, these being stiffer and more numerous than in *Ormiscodes* (*O. cinnamomea*). Wings large and broad, wider than in *Ormiscodes,* but much as in *Phricodia agis.* Fore wings not falcate, costa slightly curved, apex rectangular; outer edge only slightly convex.

Hind wings not quite so full and rounded at the apex as in *Ormiscodes,* being rather wide, and extending well beyond the end of the abdomen.

Markings: No distal spot on wings of either pair, except a diffuse sublinear irregular faint indistinct dark or white line. The extradiscal line runs very near the discal mark. Abdomen banded with brown and white, or snuff-yellow ochreous and dark brown.

As the vestiges (teeth) are smaller in *speciosa* than in the other species known to me, and since there are minute vestiges of the distal pectinations, this species may be regarded as more primitive and generalized than the two others.

Geographical distribution.—Eastern coast of South America, southern Brazil to Demarara and Trinidad, to Central America and Mexico, both the west and east coast, including Costa Rica and Jalapa, Mexico. [*D. plana* (Walk.) is described from Haiti.]

SYNOPSIS OF THE SPECIES.

Rose-pink; vestiges of distal pectinations present, fore wings elongated ..... *speciosa.*
Wings broad; basal and extradiscal lines white, interrupted; hinder end of thorax and abdomen banded with rose-pink ..... *semirosea.*
Wings very broad, chestnut brown, hind wings reaching farther beyond end of abdomen; abdomen brown, banded with ochreous ..... *hoegei.*

DIRPHIA SEMIROSEA Walker.

Plate LIII, fig. 4.

Dirphia semirosea Walker, Cat. Lep. Het. Br. Mus. [VI (1855), p. 1359].
[*Ormiscodes semirosea*] Kirby, Syn. Cat. Lep. Het., I, p. [790].

Imago.—One ♀. Palpi projecting a little beyond the front. Fore wings intermediate in shape between *D. speciosa* and *hoegei*, not so broad and rather longer and more pointed at the apex than the latter. Thorax rough and shaggy, chestnut brown, with long erect irregular whitish thickened scales which are hairlike and not decidedly flattened or paddle-shaped as in those of *D. hoegei*.

Wings very broad, the ground color chestnut brown, with a rosy tinge all over them. Fore wings with a basal line composed of an oblique heavy white spot, succeeded by several venular white spots, the line being situated half way between the base of the wing and the discal veins Extradiscal line white, accentuated on the veins and costa, not wavy or entirely straight, and curved outward on vein II_3–II_5. Half way between this line and the outer edge of the wing is a broad diffuse dark chestnut brown shade, more or less interrupted and scalloped on the outer edge. No discal discoloration.

Hind wings roseate chestnut, of nearly the same hue as in the fore wings. No discal spot or basal line. Two parallel extradiscal dark chestnut shades, the inner one becoming white on the costa; the outer one the broader, and widest on the hinder portion of the wing. Two pink bands extend across the back of the thorax.

Abdomen dark reddish brown, and with six bright pink rose bands; along the middle of the under side is a uniform brown area.

Beneath, fore wings with no basal line or discal mark except a faint linear light spot: the extradiscal line is partially reproduced.

Expanse of fore wings, ♀ 75 mm.
Length of fore wing, ♀ 38 mm.
Breadth of fore wing, ♀ 19 mm.
Length of hind wing, ♀ 28 mm.
Breadth of hind wing, ♀ 20 mm.

This species may be recognized by the beautiful roseate bands at the base of thorax and on the abdomen; also by the interrupted white basal and extradiscal lines on the fore wings.

Compared with Walker's type in the British Museum, the duplicate presented by that museum.

Geographical distribution.—"Costa Rica, Mexico." (British Museum.)

DIRPHIA HOEGEI Druce.

Plate LIII, fig. 1; CXII, fig. d.

Dirphia hoegei Druce [Biol. Centr. Amer. Lep. Het., I (1886), p. 194, pl. 20, f. 10, 11].
[*Ormiscodes hoegei*] Kirby, Syn. Cat. Lep. Het., I, p. [790].

Imago.—One ♂, one ♀. Wings broader, hind wings longer and reaching farther beyond the end of the abdomen than in the two other species known to me. Body, head in front, breast and femora reddish brown. Palpi short, black, not reaching to the front. Thorax bristling on the back with erect stiff yellowish paddle-shaped flattened hairs.

Fore wings broader than usual, costa a little more curved than in *D. semirosea*, apex rectangular, hind wings wide, with the outer edge full and convex. Wings ruddy chestnut brown, ♀ more reddish than ♂. Fore wings with a basal line of three or four white spots, that in the costa large, wide, and oblique; one situated on vein IV linear and one on vein VII. Discal spot a double dark spot, diffuse and obscure. Extradiscal line white, a little sinuous, widening on the costa, wider in ♂ than ♀, and in ♂ tending to become broken up into venular spots. Hind wings with no markings, but the very faint extradiscal line becoming whitish on the costa, and a faint submarginal irregular diffuse whitish (?) scalloped shape. Wings beneath of the same hue as above, dark, though a little paler; the extradiscal line common to both wings is scalloped and quite distinct, and the discal, linear marks are present in both wings.

The sides of the body are black brown, beneath (including the abdomen) rather bright reddish brown; abdomen above dark brown, with five ochreous bands; the end snuff-yellow ochreous.

Expanse of fore wings, ♂ 88 mm.; ♀ 104 mm.
Length of fore wing, ♂ 42 mm.; ♀ 49 mm.
Breadth of fore wing, ♂ 25 mm.; ♀ 27 mm.
Length of hind wing, ♂ 35 mm.; ♀ 40 mm.
Breadth of hind wing, ♂ 28 mm.; ♀ 26 mm.

This fine large species has much broader wings than in the other species, those of the hinder pair extending farther beyond the end of the abdomen, while the lines are white, broken up into venular spots, and the general color is ruddy chestnut brown instead of roseate.

Geographical distribution.—Jalapa, Mexico (Barrett).

DIRPHIA SPECIOSA (Cramer).

Plate LIII, fig. 2.

[*Attacus speciosa* Cramer, Pap. Exot., II (1779?), Pl. 107, B.]
Dirphia speciosa Walker, Cat. Lep. Het. Brit. Mus., VI (1855), p. 1363.—Druce, Biol. Centr. Amer., Lep. Het., I (1886), p. 195.]
[*Plateia speciosa* Kirby, Cat. Lep. Het., I, p. 791.]

Imago.—One ♀. Head and thorax dull snuff-yellow ochre; wings of both pairs of a uniform delicate rose-pink, with traces of a diffuse brown extradiscal line, and a white diffuse linear discal mark, which on the under side is very indistinct. Cramer figures it with a distinct ≻ mark, the stalk of the ≻ extending out along the extradiscal space. Beneath there are no lines or other markings. Palpi not reaching the front, not very stout, depressed. Fore wings rather produced toward the apex and hind wings well rounded on the apex. Abdomen black-brown, with five white rings on the front edge of five segments; end of the abdomen snuff-yellow. The thorax is partly denuded [of hairs], but there are no traces of erect stiff flattened ones.

Expanse of the fore wings, ♂ 88 mm.
Length of a fore wing, ♂ 45 mm.
Breadth of a fore wing, ♂ 22 mm.
Length of hind wing, ♂ 32 mm.
Breadth of hind wing, ♂ 21 mm.

This is a larger species than *D. semirosea*, with longer fore wings, which are more pointed at the apex, while the hind wings are longer.

My single specimen (a duplicate from the British Museum, and named from the British Museum collection) is rubbed and battered. By its antennal structure, the presence of vestiges of distal pectinations, which do not occur in the two other species, I infer that this is probably one of, if not the most, primitive species of the genus.

Geographical distribution.—Ega, Demarara (British Museum); Surinam (Cramer).

DIRPHIA SOMNICULOSA (Cramer).

[*Bombyx somniculosa* Cramer, Pap. Exct., II (1779), pl. 100, A. B.]
[According to Kirby, this is the type of *Plateia* Hübner.]

A large reddish brown species, in shape like *D. speciosa*, but with no discal mark. Fore wings crossed by five whitish broad shades. Abdomen banded with red and ocher. See W[alker]'s description [Cat. Lep. Het. Brit. Mus., VI, p. 1360].

[HYPERDIRPHIA Packard.]

[*Hyperdirphia* Packard, Journ. N. Y. Ent. Soc., XI (1903), p. 245, was based on *Attacus tarquinia* Cramer, described from Surinam. According to Kirby, *tarquinia* is the type of *Dirphia*. In Dr. Packard's MSS. I find *tarquinia* still in *Dirphia*, with no reference to *Hyperdirphia*, but the account was evidently written prior to the publication of *Hyperdirphia*. The diagnosis of the latter genus was as follows:]

Imago.—♂. Head narrower in front than in *Dirphia* (*D. hoegei*). Antennæ of male the same as in *Dirphia* (*D. hoegei*), pointed at the end and pectinated to the tip; the distal pectinations being a little shorter, so that the tip is more prolonged, filiform, than in *Dirphia*. Eyes large, decidedly more prominent and globose than in *Dirphia*. Palpi very much larger and wider than in *Dirphia* and extending well beyond the front; third joint distinct.

Thorax normal, not shaggy, but with a soft, rather short fur-like coat, with no long thickened hairs, such as are characteristic of *Dirphia* (*D. hoegei*).

Fore wings very short and broad, costa regularly arched, apex squarish, outer edge much as in *D. hoegei*, though less oblique. Hind wings large and wide, outer edge full and rounded, extending a little beyond the abdomen.

Venation: The discal cell is broader and the two discal veins taken together are more oblique than in *Dirphia;* also vein II_1 [$=III_1$] arises nearer the origin of the anterior discal vein, i. e., much nearer the outer end of the discal cell. In the hind wings the outer side of the discal cell is more oblique and the posterior discal vein longer than in *Dirphia*.

Abdomen banded as in *Dirphia hoegei*.

Markings: The ground color of the fore wings a frosty, tawny hue, with a peculiar, very large brown discal spot, one-half as wide at the wing itself, and broken up by the discal veins and vein IV, which are snow-white. No basal or extradiscal lines in male, but they are present in female. Hind wings ocherous tawny, with a slight dusky discal streak; no discal spots beneath.

This genus, represented by a single species, is interesting as being a connecting link between the *Dirphia* group and the *Automeris* group of genera. At first sight it would be mistaken for an *Automeris* or ally of that genus, but on closer examination it will be found to be more nearly allied structurally to *Dirphia*, especially the *hoegei* section. It is a mistake, however, to refer it to *Dirphia*, since it decidedly differs, besides the extraordinary style of coloration, in the much larger and longer palpi, the narrower front of the head, and the more elongated tip of the male antennæ. It is an intermediate form, very decidedly linking *Dirphia* with *Protautomeris* and the *Automeris* group of generic forms.

[The following occurs in the MSS. under *Dirphia tarquinia:*]

GENERIC CHARACTERS OF LARVA.

Body long, moderately thick, cylindrical, with long single slender tapering spines, not arising from a definite tubercle; each spine with setæ, not irregularly branched as in *D. consularis* Burm. = *Coloradia* [*Eudyaria*] *venata* Butler. Apparently a median hair on top of eighth abdominal segment. Evidently a generalized form, with only a single spine from each tubercle. [From Stoll's figure and description.]

DIRPHIA TARQUINIA (Cramer).

Plate LIII, fig. 9; CXII, fig. *c*.

Attacus tarquinia Cramer, Papillons Exotiques, I, p. 6, Pl. IV, A, ♀, B. C. ♂.
Dirphia tarquinia [Hübner, Verz. bek. Schmett. (1822?), p. 153].
Dirphia tarquinia Kirby, Syn. Cat. Lep. Het., I [p. 793.]

LARVA.

Dirphia tarquinia Stoll, Suppl. to Cramer's Papillons Exotiques (1781), p. 82, Pl. XVII, fig. 5.

Imago.—One ♂. Head reddish brown, a little paler, more reddish than the thorax, which is of a rich dark velvety vandyke or chestnut brown. Antennæ pale, palpi dark brown.

Fore wings pale lilac gray, with a hoary tinge; fawn colored on the costa beyond its base and toward the apex. No lines or markings except a small brown irregular patch near the inner angle of the wing. The very distinctive mark is the discal spot, which is very large, deep vandyke brown, one-half as wide as the entire wing, oval, nearly straight on the outer side and traversed by an oblique white double line following the discal veins, and by a longitudinal line on vein IV, which divides the line into an anterior and posterior half; the spot is edged with snow-white slightly tinged with pink.

Hind wings ochreous tawny inside of the discal oblique small brown streak; beyond, the wing is lilac ash-colored.

The underside of both wings is uniformly reddish-ochreous, with no discal spot or any lines.

The female, according to Cramer's figure, differs in being much larger; the fore wings are dark vandyke brown, and with a basal angulated line and an extradiscal straight white line; in the middle of the wing is a long white line nearly parallel with the inner edge, which sends off a fork or branch inward, part way toward the costa. Hind wings as in the ♂.

Expanse of the fore wings, ♂ 78 mm.
Length of a fore wing, ♂ 40 mm.
Breadth of a fore wing, ♂ 24 mm.
Length of hind wing, ♂ 33 mm.
Breadth of hind wing, ♂ 26 mm.

Geographical distribution.—Surinam; Cayenne (Donckier).

My example comes from French Cayenne.

Larva.—It is described and figured by Stoll as rather long, cylindrical, with a long single slender spine (not a fasciculus of several branching spines as in the more specialized larvæ of *Automeris, Hemileuca, Pseudohazis,* and *Coloradia*). Each spine arises directly from the surface, there apparently being no definite tubercle giving origin to it. The spines are setose. Body pale yellowish green; head green, and over the skin are scattered obscure red dots. The two first and the last segments have long tufts (touffes) nearly as long as the body is thick, with green hairs, and are yellow at the end. The other segments have each three similar "hairs" (spines), but smaller and simply green. Thoracic legs pale flesh colored; abdominal ones blue and red, and the anal ones are violet and beneath pink-red.

Cocoon.—Round, dense, gray, resembling that of *Saturnia pavonia-major.* It remains in the pupa state 10 or 11 days. Food plant, the locos tree in the forests of Surinam.

THAUMA Hy. Edwards.

Thauma HY. EDWARDS, Proc. Calif. Acad. Sci., V (1875), p. 265.

THAUMA SOCIALIS Feist.

Plate LXIII, fig. 8.

[*Bombyx socialis* FEISTHAMEL. Lépidoptères Nouveaux recueillis pendant le voyage autour du Monde de *la Favorite* sous le commandement de M. Laplace, capitaine de frégate, illustrés et décrits par M. le baron Feisthamel, in Guérin's Magasin de Zoologie, vol. 9, 1839, part 18, page 3.

Feisthamel's description is as follows:

"Alis cinereis, anticis strigis duabus maculaque obliqua albidis; posticis immaculatis; omnibus subtus striga communi alba.

"Les ailes sont d'un gris cendré, ayant à leur base des touffes de poils longs et roussâtres; les supérieures, présentent, sur le milieu de l'aile, une tache blanche ayant la forme d'un 7 dont la queue est tournée vers la base, la pointe supérieure de ce chiffre tombant plus ou moins à une raie blanche, sinuée et transverse.

"Les inférieures sont sans taches; le dessous des ailes est semblable au dessus, à l'exception d'une bande blanche sinuée, qui traverse horizontalement les ailes inférieures.

"Le corps est gris-roussâtre; le corselet est couvert de longs poils bruns; les antennes sont d'un blanc sale; le tête et les pattes sont brunes.

"Nous n'avons vu que la femelle.

"Il se trouvé au Chili."]

The female abdomen reaches to end of hind wing. Antennæ simple as in *Dirphia,* judging by Edwards's excellent photograph. The female differs from *D. hoegei;* it is very near *D. hoegei,* but the wings are not quite so wide; a white discal spot extending to[ward] but not reaching costa, and also along the vein III to middle of wing. The thorax has thickened hairs. Extradiscal line as in *D. hoegei;* other lines white and arranged as in *hoegei.* Perhaps a true

Dirphia. [Dr. Packard would doubtless have wished to revise and extend these preliminary notes. In Kirby's Catalogue both *T. socialis* and *Dirphia hoegei* Druce (from Mexico) appear in *Ormiscodes. Dirphia angulifera* Walker and *Thauma ribis* Hy. Edwards (which in Kirby's Catalogue appears in a different family) are synonyms of *T. socialis. T. ribis* (Proc. Calif. Acad., V (1875), p. 266) was said to be from Vancouver Island, where it must have been introduced. The species inhabits Peru and Chile.]

PHRICODIA Hübner.

[*Phricodia* Hübner, Verz. bek. Schmett., p. 187.]
[Kirby lists 25 species, all Neotropical except *P.* (?) *albida* Plötz, from west Africa.]

Imago.— ♀. Head, front as in *Dirphia.* Palpi small, rather slender, not reaching the front, otherwise as in *Dirphia;* the third joint well developed but drooping. [Antennæ wanting in specimen examined.]

Thorax somewhat shaggy, but with no specialized flattened scales, the vestiture being long, but soft and woolly.

Wings very broad, much as in *Dirphia,* the ♀ abdominal tip extending slightly farther than in *Dirphia,* as far as the inner angle of the hind wings. Fore wings of the same shape as in *Dirphia,* the costa only slightly arched; apex rectangular, and the outer edge slightly convex. Hind wings long and broad, much as in *Dirphia.*

Markings: Instead of a discal spot only a faint diffuse discal line as in *Dirphia;* extradiscal line oblique and not wavy, but as in *Dirphia,* irregular. Abdomen banded with snuff-yellow and brown.

Geographical distribution.—South and Central America; Jalapa, Mexico (Barrett).

PHRICODIA AGIS (Cramer).

Plate LIII, fig. 8.

[*Attacus agis* Cramer, Papillons Exotiques, I, pl. 30, F (1775).]
Phricodia agis Kirby, Syn. Cat. Lep. Het., I [p. 788].

Imago.—One ♀. Body and wings chestnut brown, head a little paler, snuff-yellow, ochreous on each side. Palpi black brown. Fore wings chestnut brown, snuff-yellow on the costal edge, and the veins also more or less snuff-yellow. A very faint diffuse smoky discal linear discoloration which is obsolete beneath; no basal line. A straight, firm (not wavy or scalloped) white extradiscal line, with the outer edge brown. No white costal spots or any other white spots.

Hind wings uniformly chestnut brown, the only mark being a faint pale extradiscal line. No discal spot. Beneath, as on the upper side of the wings, but no traces on the fore wings of the extradiscal line.

Abdomen banded with snuff-yellow and black-brown; the end snuff-yellow.

Expanse of fore wings, ♀ 100 mm.
Length of fore wing, ♀ 48 mm.
Breadth of fore wing, ♀ 26 mm.
Length of hind wing, ♀ 37 mm.
Breadth of hind wing, ♀ 27 mm.

This species in its broad wings and general style of coloration and markings closely resembles *Dirphia hoegei.*

Geographical distribution.—[Mexico to Brazil, Kirby]; Jalapa, Mexico (O. T. Barrett).

HYLESIA Hübner.

[*Hylesia* Hübner, Verz. bek. Schmett. (1822), p. 186.]
[The type of the genus, according to Kirby, is *H. canitia* Stoll from Surinam.]

Imago.— ♂ and ♀. Head rather broad in front, subtriangular. Antennæ of male short with long joints, a single pair of long well-developed pectinations, those at the base very long

and the others rapidly shortening toward the tip; the distal vestigial pectinations are very slender, longer on the outer side, shorter on the inner side, where they are about one-quarter as long as the basal pectinations, and difficult to detect; extreme tip filiform. ♀.

Palpi short, stout, with bushy scales at the broad end; third joint not easily distinguishable.

Thorax without the long subclavate hairs of *Dirphia*.

Fore wings very falcate (especially in *H. acuta*), costal edge very convex toward the apex, inclined to be slightly excavated within; outer edge quite deeply hollowed out; inner angle well rounded. Hind wings reaching somewhat beyond the end of the abdomen; apex well rounded; outer edge full, convex, inner edge nearly straight.

Markings: The wings of both pairs of the same hue and style of markings. No discal spots on either pair of wings; the markings obscure bands and lines, indistinct and diffuse in *H. alinda* and obsolete in *H. acuta*.

The species of *Hylesia* differ from those of the foregoing genera in the more falcate wings, their smaller size, the shape of the antennæ and palpi, the venation, as well as the smaller size of the moths.

Geographical distribution.—South America; Mexico.

HYLESIA ALINDA Druce.

[Plate LXI, figs. 9, 10, is *H. cressida* Dyar, formerly referred to *alinda*.]

Hylesia alinda DRUCE [Biol. Centr.-Amer., Lep. Het., I, p. 197 (1886), pl. 20, fig. 3].
Hylesia alinda [HOLLAND, Moth Book, p. 90, Pl. VIII, fig. 12].
Hylesia alinda KIRBY, Syn. Cat. Lep. Het., I, p. [792].

Imago.—Two ♂. Head, front considerably narrower than in *H. acuta*, the head and thorax in front dull roseate brick red, the thorax behind and the wings uniformly purplish brown, of nearly the same hue as in *H. acuta*; thorax with no yellow hairs.

Fore wings falcate, but not so sharp at the apex as in *H. acuta*, and the wings of both pairs are banded. Fore wings with a basal line darker than the rest of the wing, but diffuse and obscure. A large elliptical brown discal spot unites with the broad extradiscal band making a Y, the shorter arm of which is made by the discal spot. An irregular faint submarginal shade. Hind wings with two broad diffuse purplish brown bands beyond the middle of the wings, of the same hue as the bands on the anterior pair of wings.

Under side of the wings a little paler than above; the bands are reproduced, but the discal spot is very obscure and almost atrophied. Abdomen black-brown; no yellow hairs on the upper side, beneath purplish brown.

Expanse of fore wings, ♂, 40 mm.
Length of fore wings, ♂, 21 mm.
Breadth of fore wings, ♂, 12 mm.
Length of hind wing, ♂, 15 mm.
Breadth of hind wing, ♂, 12 mm.

This species lacks the yellow thoracic erect hairs.

Geographical distribution.—[San Geronimo, Guatemala (Champion); Volcan de Chiriqui, Panama (mus. Staudinger.), Druce, l. c.] Jalapa, Mexico (H. Edwards); Vera Cruz, Mexico (G. Franck).

[Also said to occur in Arizona, but Dr. Dyar writes that he is in some doubt regarding the identity of the Arizona form. Kirby gives the distribution as "Guatemala, Panama."]

[Dr. Dyar writes: "I have larvæ of three species of *Hylesia* identified (*nigricans* Berg., *euphemia* n. sp., and *coinopus* n. sp.). Stoll (Supple. Cramer, Pap. Exot., Pl. XX) figures two *Hylesia* larvæ, but he assigns them to *hirta* and *bibiana*, which are both plainly Lasiocampidæ, so they are nameless. He says of the one he calls *bibiana* 'they live in society on the tree guajaven, and spin in company and almost side by side like the *processionea* Linn., of Europe.' The habits may vary with the species. Dr. Skinner sent me one (*tapabex* n. sp.) bred from a 'gregarious podlike cocoon.'"]

HYLESIA ACUTA Druce.

Hylesia acuta Druce [Biol. Cent. Amer., Lep. Het., I, p. 197, pl. 20, figs. 1, 2].
[*Hylesia acota* (sic) Kirby, Syn. Cat. Lep. Het., I, p. 792.]

Imago.—Three ♂. Head, the front wide and, like the femora, deep roseate. Thorax dark-brown, with short coarse hairs which are snuff-yellow on the middle of the thorax forming an oval dull yellow-ochre area, and with scattered hairs of the same color behind. The distal half of the abdomen ringed with snuff-yellow; the base is velvety brown, like the thorax, the extremity is dull roseate; beneath reddish brown on the sides.

Wings of both pairs uniformly claret or dull wine red, becoming a little darker towards the apex. No trace of a basal line or discal spot. Faint traces of an extradiscal line, which is slightly curved and ends in a diffuse cloud on the outer fourth of the costal edge; an oblique dark brown streak extending from the thorax along the base of the inner edge of the fore wings. The fore wings are longer and much more falcate than those of *H. alinda*, from which the present species differs in the absence of the markings, in the yellow hairs on the thorax and abdomen, the head also being wider in front.

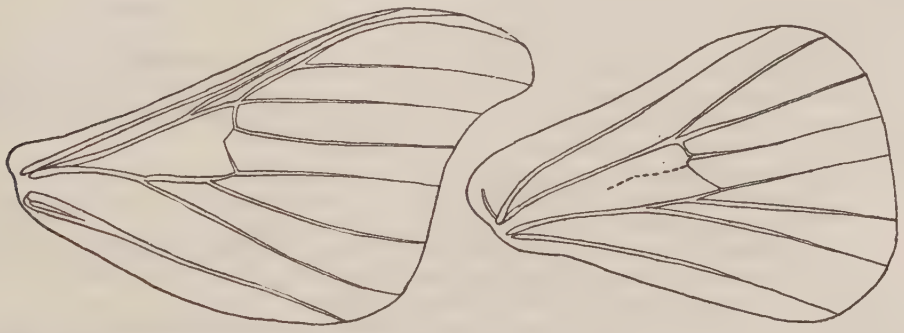

Fig. 1. Venation of *Hylesia acuta* Druce, ♂ Jalapa. No discal vein in fore wing and a very slight one in hind wing.

Hind wings with no lines or any markings. The wings beneath as above, but slightly paler, though darker on the costal and apical region.

Expanse of fore wings, ♂, 54 mm.
Length of fore wing, ♂, 25 mm.
Breadth of fore wing, ♂, 12.5 mm.
Length of hind wing, ♂, 18 mm.
Breadth of hind wing, ♂, 13 mm.

Geographical distribution.—Jalapa, Mexico (O. T. Barrett).

[Dr. H. G. Dyar has just revised the genus *Hylesia* as represented in the United States National Museum, and kindly supplies the following table:]

Table of species of Hylesia in United States National Museum.

By Harrison G. Dyar.[1]

Hind wing at least in ♂ with ocellate discal mark.
Fore wing of ♂ strongly falcate; ♀ very dissimilar.....*nanus* Walker.
Fore wing of ♂ not strongly falcate.
Ocellus of hind wing of ♂ brick-red with yellow center.....*corevia* Schaus; Pl. LXXIX, figs. 5, 6.
Ocellus red with black or crimson ring.
Hind wing of ♂ with a blunt angle below the middle of outer margin.....*lineata* Druce.
Hind wing of ♂ evenly rounded.
Ocellus of ♂ with a black ring.....*subaurea* Schaus.
Ocellus of ♂ with dull crimson ring.....*iola* Dyar.

[1] [See also Proc. U. S. Nat. Mus., vol. 44, pp. 121–134, where the new species are described. The *H. inficita* Walker of the table is the insect so determined by Schaus from Costa Rican specimens. It may not be the true *inficita*, described from Brazil. *H. aeneides* Druce runs in the table to the vicinity of *melanostigma* and *gyrex*, from which it is known by the rosy (instead of ochreous) abdomen.]

Hind wing of ♂ without ocellate discal mark, at most a diffused darker patch.
Hind wing of ♂ with rounded angle below middle.
Fore wing of ♂ with large blackish discal patch ..... *melanostigma* H.-S.
Fore wing without these markings ..... *gyrex* Dyar; Pl. LXXXI, fig. 1.
Hind wing of ♂ evenly rounded.
Fore wing of ♂ roundedly produced at apex; a brown band on basal part of inner margin oblique to the base.
Outer band of fore wing distinct, dark, broad ..... *mymex* Dyar; Pl. LXXXI, fig. 5.
Outer band absent, faint, or very slender.
Fore wing of ♂ without distinct discal mark; thorax black.
Fore wing rosy brown ..... *acuta* Druce.
Fore wing dark smoky brown.
Venter of thorax and abdomen sooty brown.
Fore wing with faint outer line ..... *hamata* Schaus; Pl. LXXXI, fig. 4.
Fore wing with outer line obsolete ..... *tapareba* Kirby.
Pectus and venter reddish, bordered with gray ..... *tapabex* Dyar; Pl. LXXXI, figs. 2, 3.
Fore wing of ♂ with large black discal mark; thorax yellow-brown.
rosacea Schaus; Pl. LXXXI, fig. 6.
Fore wing of ♂ little or not produced at apex; no brown band on base of inner margin.
Fore wing of ♂ with annular discal mark.
Feet rosy red ..... *rufipes* Schaus; Pl. LXXXIII, fig. 2.
Feet ocherous or blackish.
Abdomen black dorsally ..... *annulata* Schaus; Pl. LXXXIII, fig. 3.
Abdomen ochreous ..... *ochrifex* Dyar; Pl. LXXXIII, fig. 4.
Abdomen dark brown throughout ..... *index* Dyar; Pl. LXXXIII, fig. 5.
Fore wing of ♂ with discal mark clouded, solid, or obsolete.
Feet rosy red or rosy tinged.
Wings pale rosy; abdomen black dorsally ..... *margarita* Dognin.
Wings brown; abdomen not black dorsally.
Hind wing with ochreous tint at base of inner margin ..... *dalina* Schaus; Pl. LXXXIII, fig.
Hind wing without such tint, more or less rosy.
Abdomen of ♂ with ochreous hairs dorsally.
Outer band of fore wing shaded outward to subterminal line.
rubrifrons Schaus; Pl. LXXXIII, fig. 6.
Outer band not so shaded, though sometimes lost in the general suffusion.
♀ with lateral and terminal tufts of abdomen dark brown; ♂ larger, fore wing falcate, marks contrasting ..... *alinda* Druce.
♀ with abdominal tufts black; ♂ smaller, fore wing a little less falcate, marks contrasting ..... *cressida* Dyar; Pl. LXXXIII, figs. 11, 12.
♀ with abdominal tufts ochre; ♂ smaller, fore wing scarcely falcate, marks blurred ..... *euphemia* Dyar; Pl. LXXXIII, figs. 9, 10.
Abdomen of ♂ with rosy brown hairs only, like the thorax.
multiplex Schaus; Pl. LXXXIII, fig. 8.
Feet without any rosy tint.
Lines of fore wing appearing dark.
Outer line of fore wing broad, shaded, illy defined, or nearly lost in the general ground color.
Outer line broad, shaded.
Hind wing of ♂ with the two lines alike, joined by shading to form a band broad and dark ..... *pollex* Dyar; Pl. LXXXI, figs. 7, 8.
Hind wing of ♂ with the two lines alike, remote, separated.
valvex Dyar; Pl. LXXXI, figs. 11, 12
Hind wing of ♂ with the inner line heavier and more distinct than the outer.
umbrata Schaus; Pl. LXXXI, figs. 9, 10.
Outer line not of this character but nearly lost in the general dark shading.
♂ unknown ..... *terranea* Schaus; Pl. LXXXI, fig. 13.
♂ with the two outer lines of hind wing near the margin fairly distinct, their pale interspaces giving the appearance of pale lines ..... *murex* Dyar; Pl. LXXXI, fig. 14.
♂ with lines of hind wing very indistinct, more remote from margin and without contrasting interspaces.
Fore wing below smooth mouse gray, the veins concolorous.
ascodex Dyar; Pl. LXXXI, fig. 15.
Fore wing below rough gray, blotched with blackish, veins dark lined.
leilex Dyar; Pl. LXXXI, fig. 16
Outer line of fore wing distinct, straight, more or less narrow and not diffused.
Abdomen of ♂ black, gray below, anal tuft pale ochreous.
murmur Dyar; Pl. LXXXII, fig. 6.

Abdomen of ♂ with numerous dark ochre hairs, at least on sides and venter.
Discal spot of fore wing predominant, large and distinct, while the other markings are slender and reduced.....*indurata* Dyar; Pl. LXXXII, fig. 7.
Discal spot not predominant, though often large.
Outer line of fore wing of ♂ broad.
Inner line of hind wing of ♂ crossing the discal venules; no discal mark.
Abdomen of ♂ black dorsally.....*oratex* Dyar; Pl. LXXXI, fig. 17.
Abdomen of ♂ with ochreous hairs dorsally.
Outer line of hind wing crenulate, defining a pale lilacine marginal space.....*coex* Dyar; Pl. LXXXI, fig. 3.
Outer line of hind wing shaded; no lilacine ground.
rex Dyar; Pl. LXXXII, fig. 2.
Inner line of hind wing of ♂ passing beyond the discal venules.
Hind wing with large discal spots...*orbifex* Dyar; Pl. LXXXI, fig. 20.
Hind wing with slender mark on discal venules or none.
Fore wing of ♂ with the submarginal space distinctly marked, the pale lilacine ground sharply defined and broken before apex.
Lines of hind wing slender, parallel; no discal mark.
remex Dyar; Pl. LXXXI, fig. 19.
Lines of hind wing broader, the outer subcrenulate; a faint narrow discal mark.....*livex* Dyar; Pl. LXXXI, fig. 18.
Fore wing of ♂ with submarginal space indistinctly marked, the pale lilacine shade diffused, not broken before apex.
Fore wing with broader outer band, shading outwardly.
liturex Dyar; Pl. LXXXI, fig. 21.
Fore wing with narrower band, sharply defined outwardly.
molpex Dyar; Pl. LXXXII, fig. 1.
Outer line of fore wing of ♂ narrow, linear.
Wings lilacine tinted.
Outer line of fore wing straight; hind wing subtriangular.
falcifera Hübner.
Outer line broadly inflexed; hind wing full, rounded.
mortifex Dyar; Pl. LXXXII, fig. 4.
Wings brown tinted.
Hind wing beneath with the lines straight, approximate, the inner stronger than the outer.....*nigricans* Berg.
Hind wing beneath with the lines similar, faint, remote, curved.
lolamex Dyar; Pl. LXXXII, fig. 5.

Lines of fore wing appearing pale.
Abdomen of ♂ with dark ochreous hairs dorsally.
Fore wing rosy.
Outer and submarginal lines indicated.....*coinopus* Dyar; Pl. LXXXIII, fig. 1.
Outer and submarginal lines lost; discal mark prominent.....*continua* Walker.
Fore wing without rosy tint.
Subterminal pale shade as prominent as the other lines.
Hind wing appearing to have two curved dark lines on a paler ground.
Abdomen of ♂ with dense ochre hairs.
Abdomen of ♀ dark with few ochre hairs.
Wings distinctly marked; size larger.....*canitia* Stoll.
Wings indistinctly marked; size smaller.....*inficita* Walk.
Abdomen of ♀ densely ochre haired like the ♂.
schausi Dyar; Pl. LXXXII, figs. 10, 11.
Abdomen of ♂ gray with very few ochre hairs.
pauper Dyar; Pl. LXXXII, fig. 13.
Hind wing appearing to have a single curved pale line on a dark ground, or unbanded.
Discal mark of fore wing clouded, dark, visible; hind wing with single pale band.
Smaller, costa of fore wing dark-blotched, wings narrower, abdominal hairs dark ocher.....*mystica* Dyar; Pl. LXXXII, figs. 8, 9.
Larger, costa of fore wing concolorous, wings broader and more rounded, abdominal hairs brown, scarcely ochreous.
athlia Dyar; Pl. LXXXII, fig. 14.
Discal mark of fore wing invisible, concolorous; hind wing with only the margin paler.....*cedomnibus* Dyar; Pl. LXXXII, fig. 12.

Subterminal pale shade faint, subordinated.
Pale lines of fore wing relieved on a dark ground without bordering shades, somewhat approximate below.....*vindex* Dyar; Pl. LXXXII, fig. 15.
Pale lines with inner blackish bordering shades and strongly approximated below.....*solvex* Dyar; Pl. LXXXII, fig. 16.
Abdomen of ♂ without ochreous hairs dorsally.
Abdomen with lateral and ventral ochreous hairs..*frigida* Schaus; Pl. LXXXII, fig. 17.
Abdominal hairs entirely black.....*bouvereti* Dognin.

[*Hylesia muscula*, from Brazil, is figured on Plates LXXXIV, fig. 2, and CXII, figs. e, f, g, h, i, j.]

MICRATTACUS Walker.

Micrattacus Walker, Cat. Lep. Brit. Mus., VI, p. 1335, 1855.
Micrattacus Kirby, Syn. Cat. Lep. Het., I, p. 774.
Hylesia Herrich-Schaeffer, Sammlung Aussereur. Schmett., p. 60, 1856.
Micrattacus Rothschild, Nov. Zool., II, p. 50, 1895.
[Type of genus, *M. nanus* Walker.]

Imago.— ♂. Head wide between the eyes, which are rather large. Antennæ of ♂ short and broad; pectinations in the middle a little longer than wide(?) about 12 pairs; tip subfiliform; distal ones arise close to the basal ones, and are shorter and difficult to detect; the basal ones are densely ciliated. In ♀ antennæ simple, short. Palpi unusually short and stout, not reaching the front; third joint not distinct.

Fore wings unusually falcate, though not so much produced as in the ♂ of *Ludia;* costa not quite so much arched, but the apex is narrow and more acute, the outer edge more deeply hollowed in behind the apex, and farther behind the outer edge is full and rounded, and the inner angle well rounded. Hind wings triangular, reaching to the end of the abdomen; apex well rounded, but the inner angle not slightly produced, as in *Ludia*. In the female the shape of the wings closely resembles that of *Hylesia nigricans*, the wings being scarcely falcate, and of the same hue and with the same kind of markings. Legs moderately thick and hairy.

Venation: In fore wings very different from *Sagana*, and quite near to *Eudelia*. Vein II_1 arises just within the outer side of the discal cell (farther out than in *Eudelia*); vein II_2 wanting; vein III_2 is entirely detached, being situated in the middle of the discal cell, and becoming a true independent vein, as in *Eudelia, Ludia*, and *Henucha*. Median veins (III_3–IV_2) much as in *Ludia*. Hind wings much as in *Ludia*, differing from *Sagana* in vein III_2, being independent. The discal cell is shorter in the wings of both pairs than in *Sagana* or in *Ludia* and *Henucha*. The female as figured by Herrich-Schaeffer is very different from the male, and differs generically, the fore wings are searcely falcate, and the hind wings are not triangular, and the color is brownish, the discal spots being indistinct.

Markings: Ground color fawn brown, with a large opaque oval discal spot on both wings, those of the fore wings grayish; those of the hind wings tawny, tending to atrophy beneath, especially on the fore wings.

The wide head in front, the very short broad antennæ, the short and stout palpi and unusually falcate fore wings and triangular hind wings and its small size, with the large discal ocelli on each wing, characterize this interesting form, though the ♀ is much more generalized in shape and color.

Geographical distribution.—Neogaeic realm, coast of southern Brazil.

This genus, as shown by the venation, is somewhat intermediate between *Sagana* and the Chilean *Eudelia*, and the South African genera *Ludia* and *Henucha*. The imaginal characters are such as to show quite conclusively that these genera form a group common to the Neogaeic and Ethiopian central and South African realms.

The two sexes are remarkably unlike, and the species presents a notable example of sexual dimorphism. The male departs widely in its very falcate fore wings, its triangular hind wings, in its reddish-brown hues, and rather large round discal spots, from the dull dark obscurely colored female. The case is a much more extreme one than that of *Hyperchiria io*, or *Saturnia pavonia-minor*. It should be noticed that in venation the two sexes do not differ much; it is in the less fundamental features of shape of the wings, the colors, and the markings that the male differs generically from the other sex.

[Dr. H. G. Dyar (in litt., 1912) considers *Micrattacus* a synonym of *Hylesia*.]

MICRATTACUS NANUS Walker.

Micrattacus nanus Walker, Cat. Lep. Het. Br. Mus., VI, p. 1335, No. 1, 1855.
Micrattacus nanus Kirby [Cat. Lep. Het., I, p. 774].
Hylesia dissimilis Herrich-Schaeffer, Sammlung Aussereur. Schmett., p. 60, ♂, figs. 491, 492, ♀, 493, 1856.
Micrattacus nanus Rothschild, Nov. Zool., II, p. 50, 1895.

Imago.—One ♂, one ♀. Head, body, and wings pink-brown, the thorax has a darker velvet-brown patch on the prothorax, greatly contracting between the fore wings, and widening again to the abdomen, the basal ring of which is dark, the remainder paler brown than the wings. Fore wings with a faint dislocated basal line, a little nearer the discal spot than the base of the wing. Extradiscal line firm, not wavy, but extending forward in an oblique course and disappearing before reaching the apex. Discal spot a large oval, peculiarly hoary, tawny spot, with an eccentric darker dot. An obscure dark shade, zigzag on the outer edge, just beyond the extradiscal line. Hind wings of the same hue as the fore wings, but the outer edge more reddish-ochreous, and containing a faint, diffuse, submarginal line. Discal spot not so large as on the fore wings, but dull ochreous yellow, and centered by a dark spot.

Beneath the discal spot on the hind wing is one-half as large as above; that on the fore wings is obsolete; the fore wings are paler on the posterior half and the hind wings with more decided yellow and ruddy hues on the outer edge than above.

Expanse of the fore wings, ♂ 39 mm.; ♀ 49 mm.
Length of fore wing, ♂ 20 mm.; ♀ 25 mm.
Breadth of fore wing, ♂ 10 mm.; ♀ 12 mm.
Length of hind wing, ♂ 15 mm.; ♀ 17 mm.
Breadth of hind wing, ♂ 10 mm.; ♀ 11½ mm.

Female.—Very closely resembling *Hylesia nigricans*, having the same cut of the fore and hind wings, the same dark brown hue, discal spots and line. Body and wings dark umber brown, abdomen tawny brown; the thorax darker than the wings. No distinct basal line; a roundish dark umber discal discoloration just beyond which is an oblique but not wavy extradiscal line, nearly parallel with the outer edge of the wing. Hind wings with a very faint small discal spot and a submarginal indistinct diffuse wavy shade. Apex of the fore wings, beneath as well as above, tawny yellow; wings beneath slightly paler than above, but the discal spots smaller and less distinct.

This is one of the smallest forms of the family, and in its shape it recalls the genus *Attacus*. Its pink-brown body and wings, the large velvety-brown patch on the thorax, and the large ocelli in each wing give it a peculiar facies. It is, with *Sagana*, the South American ally of a number of forms belonging to a side group which characterizes the South African fauna, the ocelli, however, being more normal than in the other genera.

Geographical distribution.—Thus far this species has only been collected at Rio Janeiro, though in the Edwards collection of the American Museum of Natural History at New York there is one from "Caruvado, Brazil." I am indebted to Mr. William Schaus for the example described.

MICRATTACUS VIOLASCENS Maass. and Wern.

Micrattacus violascens Rothschild, l. c.

Micrattacus bulæa Maass. and Wern. is a true *Automeris* (cf. Rothschild, l. c.).

PROTAUTOMERIS Packard.

[*Protautomeris* Packard, Jn. N. Y. Ent. Soc. XI (1903), p. 254.]

Imago.— ♂. Head moderately broad, narrowing somewhat toward the labial region. Antennæ of ♂ much as in *Dirphia* (*D. hægei*), not very long but differing from *Dirphia* in the extreme tip being subfiliform; the distal pectinations about three-quarters as long as the basal ones; the joints in the middle of the antennæ rather short.

Palpi stout, porrect, slightly exceeding the front, and with close scales; third joint distinct, but short and somewhat depressed.

Thorax stout, with a few fine slender but long hair-like scales, i. e., flattened hairs, on each side of the patagia.

Fore wings much as in *Automeris*, the wings more falcate than in *Dirphia;* costa well curved before the apex which is subacute; outer edge much shorter than the inner and very slightly concave. Hind wings much rounded at the apex; outer edge full and convex, the inner angle extending as far as the tip of the abdomen.

Venation: Differs from that of *Automeris io* in vein II (first subcostal) arising nearer the middle of the discal space, while the independent vein arises near the middle of the discal space, i. e., the two discal veins are of nearly the same length, while in *A. io* the anterior discal is very much shorter than the posterior. In the hind wings the discal cell is narrower than in *A. io*.

Colors and markings: Very similar to those of some of the species of *Automeris*. A curved irregularly scalloped basal line; extradiscal line strongly marked, oblique, a little curved and ending as in *Automeris* at the apex. Ocellus faint, much as in *Automeris*. Hind wings with a well-marked very large ocellus of the *Automeris* type and partly surrounded by a heavy black extradiscal line.

Abdomen lake-red, but tawny yellowish at tip.

This genus is based on *Dirphia mæonia* of Druce, the only species yet known.

Geographical distribution.—So far as yet known the single species of the genus is confined to Mexico, but may be found to extend into Central America.

This rather remarkable genus is a very interesting annectant form between the two principal subdivisions of the family Hemileucidæ represented by *Dirphia* and *Automeris*. It differs from *Dirphia* and *Hyperdirphia* in the much smaller palpi, which are much as in *Automeris*, being of about the same length, though the antennæ are of the same shape as in the two former genera. In the shape of the wings it approaches *Automeris*, and still more in the markings in which it is in advance of its structural features, having the oblique extradiscal line of the fore wings, and the very large and perfect ocellus of the hinder ones. The erect long hair-like thoracic scales may be an inheritance from *Dirphia*, while in the single known species the abdomen is not striped with dark and yellow, but is reddish carmine. It is most probable that the *Automeris* group originated from a form similar to this. Its larval history would be most interesting.

PROTAUTOMERIS MÆONIA (Druce).

Plate LIII, fig. 7.

Dirphia mæonia Druce [Biol. Centr.-Amer., Heter. II (1897), p. 426, Pl. LXXXV, fig. 3].

Imago.—One ♂ (?). Head and thorax and base of fore wings of a rich dark chestnut or vandyke brown, paler beneath. Palpi and legs (tibiæ and tarsi) light Indian red; palpi brighter red than the legs; femora brown, of the same hue as the underside of thorax.

Fore wings: Basal line situated halfway between the base of the wing and the discal spot; it is divided into two scallops, a small one in the base of the discal cell, the other very large and extending to the inner edge of the wing on the inner third; the line is yellow within, edged externally with white. Extradiscal line very distinct, yellow edged within with white; it begins a little beyond the middle of the wing and ends almost directly on or just before the apex; it is oblique, slightly incurved in its course. On the outside there is a brown shade, but the middle of the wing and the outer edge are of a peculiar pale gray with a slight purplish or flesh tint. Discal spot an oblong irregular chestnut cloud nearly of the same shape and distinctness as that of *Automeris*.

Hind wings much rounded on the apex; the outer edge very full and convex; at their base they are quite hairy and of a dull pink; there is no basal line. The ocellus formed of a large, nearly round broad black ring inclosing a dull pinkish area concolorous with the base of the wing, the center free from long scales, and with a few white scales; it is not naked or transparent. Between the ocellus and the much curved black extradiscal line is a larger rich ochre-yellow patch. A broad diffuse extradiscal line is a large rich ochre-yellow patch. A broad diffuse dark pink-brown [suffusion ?], the wing being dull pink in hue. The veins on both wings are distinct and strongly marked with brown scales.

Underside of the wings of a uniform pink gray, the pink deepest in hue on the hairy portion of the inner edge of the hind wings. Only a faint diffuse line on the fore wings representing the extradiscal line, but ending much farther from the apex on the outer fourth of the wing. A similar shade crosses the hind wing where the ocellus would be if present. No distinct traces of discal spots.

Expanse of the fore wings, ♂ 78 mm.
Length of a fore wing, ♂ 40 mm.
Breadth of a fore wing, ♂ 23 mm.
Length of a hind wing, ♂ 30 mm.
Breadth of a hind wing, ♂ 23 mm.

Geographical distribution.—Vera Cruz, Mexico (G. Franck).

AUTOMERIS Hubner.

[*Automeris* Hubner, Verz. bek. Schmett., p. 154 (1822?).]

[The type of the genus, according to W. F. Kirby (Cat. Lep. Het., I, p. 776), is the Neotropical *A. janus* Cramer. Grote also so restricted it in 1874.]

Imago.— ♂ and ♀. Head moderate in size; front subtriangular, rather closely cropped, much more so than in *Dirphia* or *Hemileuca*. Male antennæ well pectinated to the tip, but not so subplumose or broad at the end as in *Hemileuca* and *Pseudohazis;* joints moderately long; the pectinations not so regularly curved as in *Hemileuca* etc.; distal pectinations long and slender, two-thirds to three-fourths as long as the basal ones. In ♀ the joints are simple, about as long as broad, with no teeth (vestiges of pectinations), but bearing two or three lateral setæ on each side. Palpi distinct, porrect, well developed, the third joint distinct, reaching out as far as the front, in some species extending beyond it, when denuded; the third joint is seen to be cylindrical, square at the end.

Thorax clothed with rather dense scales, which are closely cropped, compared with the species of *Dirphia*.

Fore wings subfalcate; costa considerably arched; apex more pointed than usual; outer edge nearly straight, only slightly excavated. Hind wings reaching either well beyond the abdomen or only slightly beyond; apex rounded; outer edge full and convex, in *A. io* well rounded.

Abdomen not banded, and concolorous with the hind wings.

The coloration in most of the species is very distinctive; the ground colors are reddish or olive-green, tawny, or yellow. As a rule there is no discal ocellus on the upper side of the fore wings, but on the underside it is very large and fully formed; it is represented above by two rows of dark dots inclosing a slightly darker space, which is either irregularly oblong or roundish. On the hind wings there is a very large distinct multicolored ocellus, and an outer black curved extradiscal line, which is represented on the underside by a white dot.

The sexes in some species, as *A. io*, are very unlike in ground color, the male being yellow, while the female retains the generic hues.

The genus is readily recognized by the subfalcate acute fore wings, and rounded hind wings, while the discal ocellus of the hind wings is large and complete, there being none on the upper side of the anterior pair, though there is a large one on the underside.

Geographical distribution.—This genus, so abnormally rich in species, is characteristic of Brazil and the forest region generally of South America, as well as Central America and Mexico, while only a single species spreads over the eastern United States and Canada.

AUTOMERIS IO (Fabricius).

Plate XIX, fig. 7; XX, fig. i; LIV, figs. 4 (*varia*), 5; LX, figs. 1–4; LXVIII, fig. 8.

[*Bombyx io* Fabricius, Syst. Ent., p. 560, n. 16 (1775).]

Imago.— ♂, ♀. Body and wings of male bright ochreous yellow; those of the ♀ grizzly rust-red, and thorax rust-red. Fore wings of ♂ not very sharp at the apex; a narrow oval

discal spot surrounded by five or six reddish dots, an interrupted basal reddish line situated halfway between the base of the wing and the discal spot. Extradiscal line scalloped, reddish, more or less distinct, not undulating or very oblique; wing along the inner edge dull reddish pink.

♂. Hind wings pink on the inner edge, and of a faded brick-red hue on the costal edge; bright yellow in the middle. A large discal spot black, with a minute white central line surrounded by blue scales. Extradiscal line heavy, black; between this and the outer edge is a heavy dull red-pink line. Fore wings beneath with a discal spot of moderate size, and an extradiscal oblique firm line. Hind wings with only a small white discal spot, beyond which is the straight extradiscal line.

♀. The head and thorax rust-red; fore wings grizzly rust-red; their base with erect irregular shaggy hairs; a basal zigzag whitish line formed of two scallops; extradiscal white [or pale] line of eight scallops, the line not undulating; a faint irregular submarginal line.

Hind wings dull brick reddish on the costal, outer, and inner edges, the middle inclosing the ocellus and extradiscal line bright yellow, the submarginal line much deeper reddish than the edge of the wing. Beneath, the ocellus of the fore wing is smaller in proportion than that of the ♂, but not so regularly round, being somewhat oval. Wings of both pairs of the same hue, paler than above, with more ocherous scales.

Expanse of fore wings, ♂ 62 mm.; ♀ 80 mm.
Length of fore wing, ♂ 28 mm.; ♀ 37 mm.
Breadth of fore wing, ♂ 16 mm.; ♀ 22 mm.
Length of hind wing, ♂ 21 mm.; ♀ 28 mm.
Breadth of hind wing, ♂ 16 mm.; ♀ 23 mm.

Aberration.—One ♂. General color yellow, like the normal male, and is of the same size.

Fore wings with the basal line broad, especially on the inner edge; it is interrupted behind the costa. Extradiscal line distinct on the costa and toward and on the hind [margin] dilating into an irregular reddish patch on the inner angle. Discal spot on the upper side normal.

On the underside of the fore wings the discal spot is represented by a very large smoky black spot consisting of a central round spot of the same size as the normal spot on this side of the wing and centered by a small white irregular dot; beyond the black spot the black suffused portion expands and extends to the extradiscal line, and is about 6 mm. in length; it also extends inward from the discal spot and is interrupted by the yellowish veins. Outer edge of the wing yellow; inner edge deep pink as in the normal ♂.

Hind wings as above, much suffused with black, since all the space from the normal black portion to the extradiscal black ring which it includes is filled in with coal black. The entire black area is about 12 by 10 mm. in extent. The submarginal reddish line is twice as wide as in the normal ♂, and much suffused, with some black scales, and the pink inner margin is stained with black scales. Fringe as in normal ♂.

Hind wings beneath as in normal ♂.

Abdomen as usual.

I am indebted to Mrs. A. T. Slosson for the opportunity of examining and describing this interesting example. It was taken at light in July, 1901, at Franconia, by Dr. W. C. Prime.

[A form called *argus* by Neumoegen and Dyar, Canad. Entom. XXV (1893), p. 123, was described as follows:

♂. Head, thorax, body, legs, and wings light yellow. Both wings uniform in color, with some darker basal tints. On secondaries a prominent blackish-blue ocellus with white central lunule, surrounded by an outer semicircular black line.

Below a large black discal spot, with white central kernel on primaries, and faint traces of the transverse lines on both wings. This aberration, which seems extremely rare, is immediately recognized by its immaculate wings, showing only the large ocellus on secondaries. Caught at Hoboken, N. J.]

[A variety of *A. io* was taken by Snow in Gallinas Cañon, N. Mex.]

[Variety *fusca* Luther, Jn. N. Y. Ent. Soc., 1907, p. 131, was described from Rhode Island.

Dr. Dyar states that this is the ordinary North Atlantic form. The name *fusca* is preoccupied in *Automeris* (*fusca* Walker, 1855), and the race described by Luther may take the name *A. io lutheri*.]

[Some individual aberrations of *A. io* have been described by H. H. Newcomb.]

[At Boulder, Colo., *A. io* presents what may perhaps be considered a local race (*coloradensis* nov.). The females are similar to var. *fusca* Luther in general appearance and markings, but the anterior wings are usually a deep vinaceous with a strong purple suffusion; the pale markings are only moderately developed, and have a greenish appearance (actually due to a mixture of pale yellow and grayish-white hair-like scales). The broad submarginal band agrees with *fusca;* in typical *A. io* (Pl. LX, fig. 4) this region is more or less pallid and the evident band incloses the faint post-median line of pale scallops. (See also Holland, The Moth Book, Pl. IX, fig. 5.) One example, however, is a lighter, more cinnamon red, and approaches Holland's figure quite closely.[1]

The Boulder males do not present any marked characters, except that the anal region of the primaries is generally strongly washed with vinous. The discal patch on primaries is strongly marked. This male is like *fusca* in markings, rather than typical *io*.

In Nebraska *A. io* is rare, and Prof. M. H. Swenk reports (litt. July, 1912):

"Our collections contain only three specimens, all females, taken as follows: Lincoln, May 29, 1894; Jamaica, April 18, 1903, and Halsey, May 29, 1912. The latter locality is in the middle of the State in the sand-hill region. All three of these specimens look enough like the colored figure of this insect in Holland's 'Moth Book' to be the original of it."

The Nebraska form is evidently like that occurring eastward, and not *coloradensis*.]

[*Geographical distribution.*—From the Atlantic coast west to Colorado and New Mexico. The following localities are represented by the records of *A. io* preserved at the United States Department of Agriculture: Maine (Bowdoinham); Connecticut (New Haven); Massachusetts (Norwood, West Medford); New York (Millers Place, Alton); New Jersey (Garfield); Pennsylvania (Honesdale, Dreshartown, McCrays); Vermont (Burlington); District of Columbia (Washington); Virginia (Falls Church, Linville); Maryland (Elk Ridge, Cumming Freedom); North Carolina (Wilkesboro, Raleigh, Asheville); Florida (St. Petersburg); Georgia (Smithville, Grayton, Macon); Tennessee (Northville); Alabama (Citronelle); Louisiana (Brodnax); Arkansas (Helena); Texas (Hockley); Oklahoma (Eakly); Kansas (Oswego); Missouri (Cadet); Ohio (Rogers); Iowa (Libson); Minnesota (Hastings). Mr. T. Pergande notes that larvæ feeding on cotton were received from P. Richert, Franklin, Tex., and from E. W. Thompson, Smithville, Ga. Years later larvæ of *A. io* were received from B. H. Brodnax, Brodnax, La., with the statement that they were present in thousands on his cotton, stripping many plants of their leaves. (MS. note by Coquillett.) In 1888 a larva was found feeding on saw palmetto by R. Ranson, Sea View, Fla. It was sent to Washington, where it was fed on rose, and produced a moth (note by Pergande).]

Life history.

The gregarious caterpillars of this moth were observed on the aspen at Brunswick, Me., July 27; the young larvæ, apparently just hatched, occurred July 16, forming a group on an aspen leaf.

Young larva after hatching.—Stout, thick bodied; the body is uniformly pale reddish brown, while the large branching spines are brown and black. Length, 5 to 6 mm.

Young larva 15 mm. in length.—Body moderately thick, or the usual shape of the genus. Body pale reddish horn-colored, with six longitudinal paler lines; four rows of dorsal and subdorsal black spinulated spines; and also a similar lateral row (or six rows in all). Head blackish-brown.

[1] A full-fed larva of *coloradensis*, collected at Boulder by Miss B. Moore, Sept. 1, 1912, presented the following characters: Dorsum very pale greenish turquoise, deepening to a light emerald green above the lateral band; lateral band with its upper part (enclosing spiracles) rather dull blood red or brick red, enclosing small inconspicuous white spots, its lower part pure white, edged below, at beginning and end of each segment, with red. Head very pale green, region of mouth ochreous, mandibles dark apically. Spines light yellowish green (apple-green), black-tipped, the black not clearly evident without a lens. Thoracic legs largely red; abdominal legs apple-green, the shining plates above the feet pale red with light tubercles from which arise many (one from each) pale bristles; feet red.]

After molting, July 28.—Length, 17 to 18 mm. The spinules on the spines are mostly whitish (those at the ends black), giving a grayish appearance to the larva. Head reddish amber; body, reddish-yellow.

Larva after another molt, August 6.—Length, 30 to 35 mm. As soon as the old skin is cast, and while the parts are limp and soft, the spines present a curious appearance; the spinules being short, and placed close together, so that the whole spine forms an elongated conical mass. Soon the spinules stand out and the larva presents the normal appearance. It is now much lighter than before, all the spines being dense and pale, but afterwards they become wholly black or black at the ends, including the hairs, though the general effect of the mass of spines is to give a pale horn-colored yellowish-green hue to the body. Color of the body as before, but there is a distinct broad deep orange spiracular line, edged slightly above, and broadly below, with whitish. The head is blackish in front, with a whitish V-shaped mark and a whitish dash in the middle of the V or clypeus; labrum whitish.

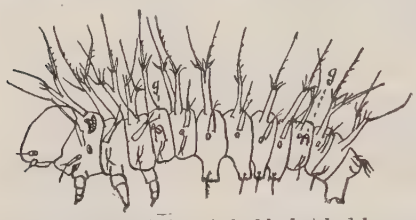

FIG. 2.—*Automeris io.* A freshly hatched larva, showing the eversible glands (*g*), etc.

Full-fed larva, molted August 16 to 20.—Same characters as before the last molt, only differing in being much larger. Body cylindrical, with stout spinulated spines arising in whorls from small conical tubercles, arranged in seven rows on the thoracic and five rows on the abdominal segments; the spinules at tip very sharp and poisonous, often ending in a stiff hair; about twelve spinules on each tubercle, some of the lateral abdominal thoracic spinules tipped with black. Head of the usual size, rather large, pea-green; the eyes, except the posterior one, situated on a black spot; labrum pale amber. Body and spines pea-green. On the abdominal segments is a lateral broad bright reddish spiracular band, broadly edged with white below; this line extends to the end of the outer side of the anal legs. Spiracles whitish, narrowly edged with black; ends of the abdominal legs and entire thoracic legs reddish. Length, 60 mm.

Larvæ were found on beech at Jackson, N. H., September 10.

[The following account of the transformations of *A. io* appeared in Proc. Amer. Philosophical Society, XXXI (1893), pp. 168–171:]

At Brunswick, Me., the eggs were laid in confinement, June 5–7, and the larvæ hatched June 25, or about three weeks afterwards. Another year, larvæ in the second stage were observed July 16. For an excellent but brief description of all the stages see Riley's Fifth Rep. Ins. Missouri, 135; also Lintner's Entomological Contributions, II, 146. Both authors state that there are six stages.

Egg.—1.8 mm.; width, 1.4 mm. It is regularly oval-cylindrical in form and slightly flattened; yellow during early embryonic life, with sometimes an orange spot on each side. Under a high-power triplet the surface of the shell is seen to be very finely granulated (not smooth and shining), and under a one-half-inch objective the surface is seen to be divided into close-set, very small, slightly raised but flattened areas, separated by narrow valleys; the areas are very irregular, but often are somewhat polygonal in outline.

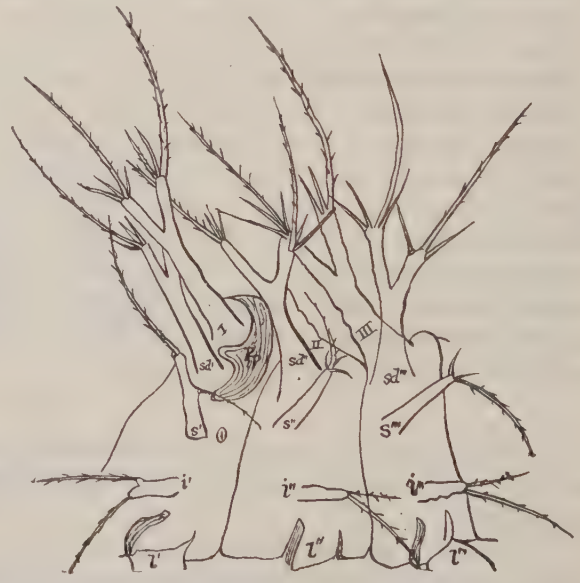

FIG. 3.—*Automeris io.* Armature of the three thoracic segments, stage I.

Larva.—Stage I. Length, 5.5, when freshly hatched; the head, 0.8 mm. in width. The body is uniformly yellowish brown; the head and spines are dark, blackish brown. All the feet, both thoracic and abdominal, are of the same color as the body. The spines are in four rows, i. e., there are eight on each segment, except on those bearing the abdominal legs, when the smallest or infraspiracular ones are wanting. The eversible glands are well developed; a pair on the first and a second pair on the seventh abdominal segment; they are situated behind the spiracle of their segment and between the subdorsal and spiracular row of spines. The spiracles are very small and hard to detect in

this stage. The subdorsal spines are about as long as the body is thick, the dorsal ones a little thicker and longer; they end in usually fine setæ, one of which is finely barbed about as long as the spine itself. Both the subdorsal and dorsal spines of the three thoracic and of the eighth and ninth abdominal segments are deeply forked, the forks of equal length and each bearing the long bristle as well as four or five short ones. Those of the other segments are not forked. The first thoracic dorsal and subdorsal spines are as long and large as those on the two hinder segments. The spines are represented in figure 6.

Figure 2 represents the freshly hatched larva, drawn with the camera, with the lateral, eversible glands (*g*).

Figure 3 represents the armature of the three thoracic segments. *Pp*, the prothoracic shield; I, II, III, the bifid

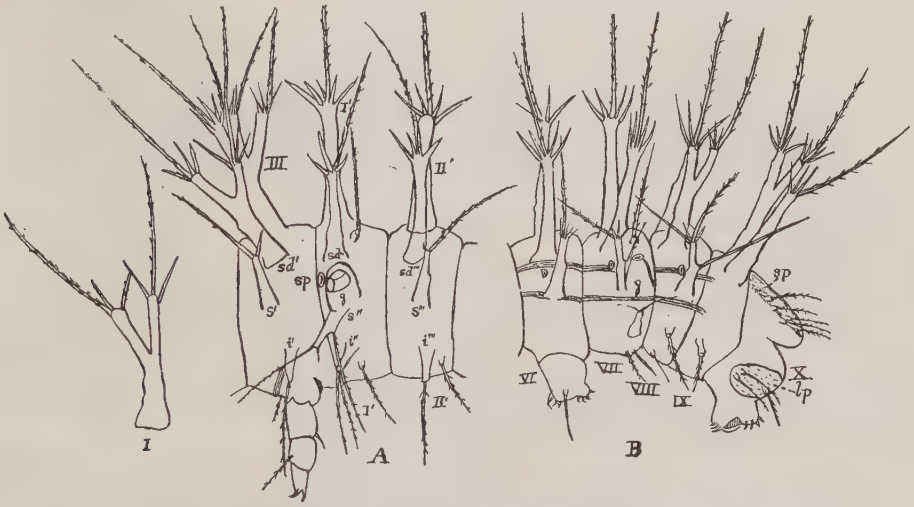

FIG. 4.—*Automeris io.* Armature of the last thoracic and abdominal segments, 1, 2, 6–10, stage I.

dorsal spines of the three thoracic segments, about three-fourths or four-fifths as long as the segments are thick; *sd'*, *sd''*, *sd'''*, the bifid subdorsal spines; *s'*, *s''*, *s'''*, the spiracular spines; the prothoracic ones throw off a bristle near the middle; in those behind this bristle is wanting; they are inserted just in front of the spiracle, the corresponding ones, however, on the abdominal segments being situated just below the spiracles; *i'*, *i''*, *i'''*, the small infraspiracular spines which are about half as long as the spiracular ones; *l'*, *l''*, *l'''*, insertion of the thoracic legs.

Figure 4 represents the armature of some of the other segments. A, the third thoracic and the first and second abdominal; III, I', II'', the dorsal spines; and the other lettering as before; *sp*, the spiracle; *g*, the lateral eversible gland of the first abdominal segment. B, the sixth to tenth (and last) abdominal segments; faint traces of the spiracular and infraspiracular yellowish lines are to be seen, hence the mediodorsal, the subdorsal, and the two lateral longitudinal lines of the larva in its second stage are already indicated in the first stage. The abdominal legs each bear eight ungues, or four on each side; and all except the anal legs bear a piliferous wart just above the planta; *sp*, the rugose suranal plate, bearing five piliferous warts on each side; *lp*, the lateral plate of the anal legs, with three or four piliferous warts.

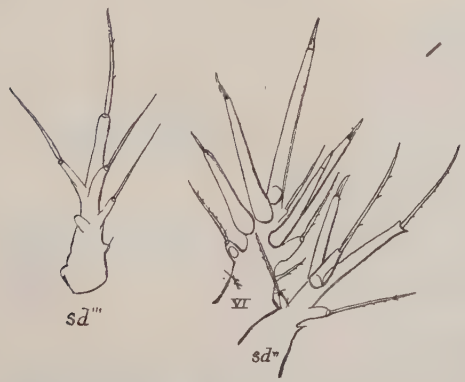

FIG. 5.—*Automeris io.* Armature of the sixth abdominal segment, stage II.

Stage II. Length, 7 mm.; width of head 1.3 mm. The head is chestnut-brown. The body is uniformly reddish umber-brown; the spines are blackish brown, with the spines black at the tip. *The dorsal and subdorsal spines are now approximate in shape to those of the last stage, being bulbous at base, and with radiating stout spinules, but the latter are less in number than in the fifth and sixth stages.* The dorsal spines of the prothoracic segments are bifid, the forks of the same length, and each bearing a long hair; along the trunk are pale scattered tubercles, each ending in a long hair. The second thoracic dorsal spines have but one terminal piliferous spinule and a single lateral one, the other spinules ending in a sharp black point. The third thoracic is like all the abdominal dorsal spines which bear radiating spinules, not ending in a single piliferous spinule, as in figure 9, *vi*.

Figure 5, *sd'''*, represents a spine of the subdorsal series, the one figured being that on one side of the third thoracic segment, but those on the abdominal segments (except *x*) are like it, though most of the abdominal ones have two or three small tubercles near the base which bear barbed bristles, as at *sd*^{vi}. All the long setæ bear a few minute barbs.

In stage IV (?), when the larva is 20 mm. in length, the prothoracic dorsal spines are nearly twice as long as the second thoracic; the latter, however, have more spines at the base than those in front, and the lateral terminal are a

little shorter than those on the first thoracic segment. The two dorsal spines on the third thoracic segment are, in size and spinulation, now exactly like those on the abdominal segments 1–9. The median double one on the eighth abdominal segment is thicker than the single ones in front, also higher, and ends in two spines; the lateral spines are much more numerous than those in front. The spines of the subdorsal series are alike on both the thoracic and abdominal segments.

Last stage: The shape of the dorsal spines of the larva in its final stage is represented by figure 6. I, a prothoracic dorsal spine, ending in two equal terminal piliferous spinules, with seven or eight just below it, while at and near the base are the long, pale spines, each ending in a sharp black point; II, one of the second thoracic dorsal spines, the base short, bulbous, with very numerous radiating spines, and a single terminal, central piliferous spine, with a smaller one near it; III, a bush-like dorsal spine of the third thoracic segment, no piliferous spinules present. The abdominal dorsal spines are all on the same type.[1] The median spine on the eighth abdominal segment is about twice the size of the other dorsal single ones in front, though no higher, and it spreads more, having about twice as many spines on the sides. On the ninth segment are two dorsal and two subdorsal ones, and behind these four on the same segment is a median one. *These types are already attained in stage II, though the spinules are fewer in number.*

It is to be noticed that the characters of the full-fed larva appear in large part in stage II, and are almost fully developed in stage III.

Figure 7 represents the spiracle and lateral eversible gland of the full-fed larva; *g*, the eversible gland; *sp*, spiracle; *g'*, an eversible gland, enlarged.

In the large dark (in alcohol) larva of *Hyperchiria*, or perhaps of a *Gamelia*, referred to by me in *Proc. Bost. Soc. Nat. Hist.*, XXV, 91, the dorsal spines of the three thoracic segments are represented by figure 8. I, a prothoracic; II, one from the second thoracic; III, one from the third thoracic; VII, one from the seventh abdominal segment. It will be seen that the spines of this species are rather more generalized than in the mature *A. io*, and approximate those of the second stage of that species; the dorsal spine of the third thoracic segment ending in three piliferous spinules, there being no piliferous spinules at all in the homologous spines of *A. io;* the abdominal spines also (VII) ending in three piliferous spinules, though the other spinules are much (about one-half) less numerous.

Intermediate between those of *A. io* and the Mexican species is the *Hemileuca artemis*, from Las Cruces, N. Mex. (fig. 9), in which the prothoracic dorsal spine is like the Mexican form, the second thoracic dorsal spine like the prothoracic ones of *A. io*, and the third thoracic dorsal tuft like the second dorsal one of *Hemileuca yavapai* from Arizona. In this last species the dorsal tufts of the body, as a whole, are intermediate between *H. maia* and *A. io*, but as regards the second and third dorsal and the dorsal abdominal ones, it approaches much nearer to *A. io*, as will be seen by an examination of the figures, the second and third thoracic spines being alike in shape. Hence the most generalized or primitive form, as regards its larval armature, appears to be the genus *Hemileuca*, and *H. maia* is the most like the young larva of *Automeris io;* then succeeds the Cordova larva, then the New Mexican larva, while *Hemileuca yavapai* is more modified, *Automeris io* being the most so of any under consideration and this may have been the last to be evolved.

AUTOMERIS LILITH (Strecker).

Plate LX, figs. 5, 6.

[*Hyperchiria lilith*, STRECKER, Lep. Rhop Het. (1878), p. 139; pl. 15, fig. 17; Georgia.]

The ♂ is not yellow, but with brown fore wings; the ♀ is like that of *A. io;* when the ♂ is yellow on the fore wings it is much deeper yellow than in *A. io.*

Larva.—Stage I: The freshly-hatched larvæ differ from *A. io* in being bright green, not brown as in the stem or *io* form. After the first molt they become more yellowish.

[The following appeared in Proc. Amer. Phil. Soc., XXXI, p. 171:]

About a dozen living specimens of these interesting caterpillars were kindly presented to me by Mrs. Annie Trumbull Slosson, who had collected them at Punta Gorda, Fla., where they were found in March feeding on the mangrove. They were described April 6. Mrs. Slosson considered them as belonging to Strecker's var. *lilith.*

Length 20 to 25 mm. The body is yellowish green all over. The lateral broad, reddish, spiracular band is as in northern specimens of *H. io;* it is broadly and distinctly bordered below with white. The head and all the legs, both thoracic and abdominal, are straw-yellow. The spines in general are bright, straw-yellow, more yellow than the body; the ends of the dorsal ones on the prothoracic segment are black, while the ends of the long spinules in general are more or less black, some merely tipped with black.

This is apparently a case of acceleration of development as *the larva in its second (or third) stage resembles in coloration the full-grown northern form of the larva of H. io,* the markings, including the lateral reddish and white spiracular line, being as in the full-fed normal larva of

[1] The spines have been somewhat flattened, but have been drawn with the camera.

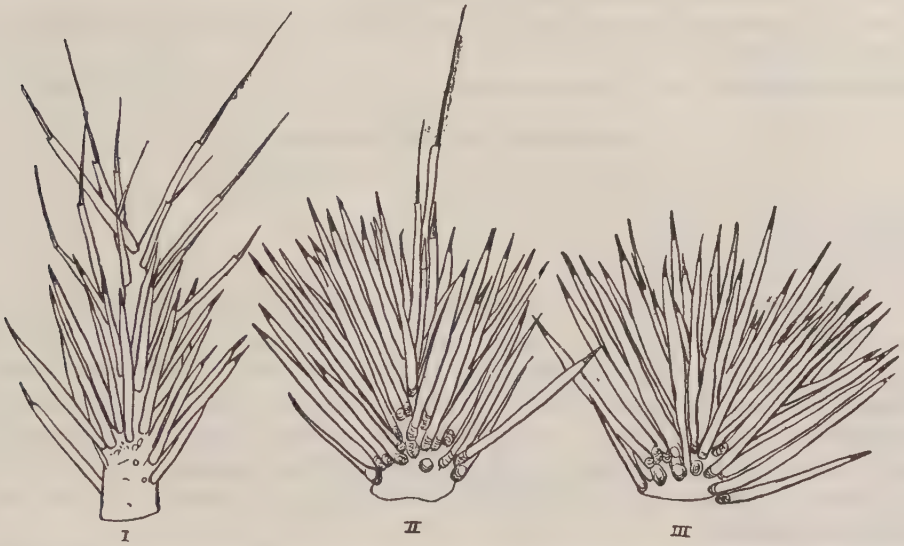

FIG. 6.—*Automeris io.* Spinulated dorsal tubercles of each thoracic segment, final stage.

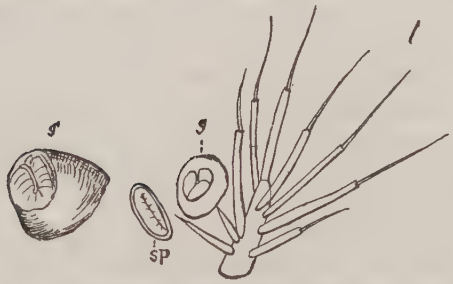

FIG. 7.—*Automeris io.* Eversible gland, with the adjoining spiracle, *sp.*; *g'*, a gland enlarged.

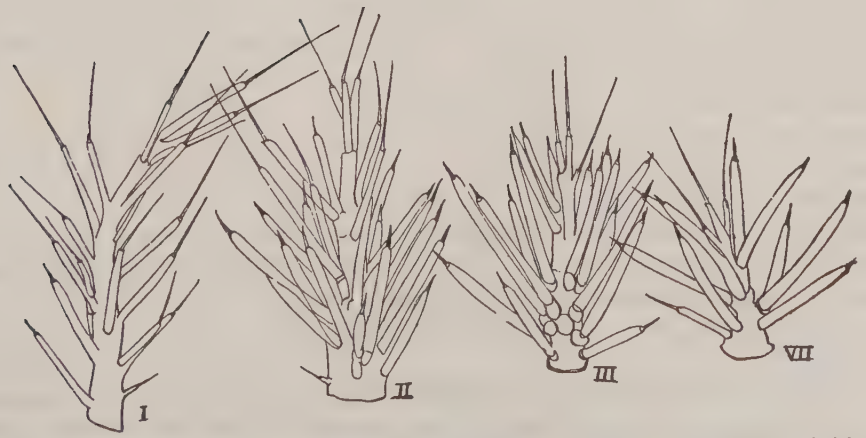

FIG. 8.—*Hyperchiria*, sp. from Mexico. Armature of final stage; dorsal tubercle of each thoracic and of the seventh abdominal segment.

H. io, and the general color of the body and spines being yellow, instead of gray and reddish, as in the normal *H. io* in its second and third stages.

Food plants.—Leaves of the mangrove; also feeds on *Conocarpus erecta* Jacq., which is related to the mangrove.

Geographical distribution.—The moths occurred at Punta Gorda (Mrs. Slosson).

AUTOMERIS PAMINA (Neumoegen).

Plates XIX, figs. 1–6; LIX, figs. 8, 9; LXVII, figs. 6, 7.

Hyperchiria pamina NEUMOEGEN, Papilo, II, p. 60, 1882.
Hyperchiria pamina var. *aurosea*, NUEMOEGEN, Papilio, II, p. 61, 1882.
Hyperchiria pamina KIRBY, Syn. Cat. Lep. Het. I.
Automeris pamina NEUMOEGEN and DYAR, Journ. N. Y. Ent. Soc., II, p. 127, September, 1894.

Imago.—One ♂, one ♀. Head a little wider in front than in *A. io*. Palpi of ♂ rather stout, not reaching the front. Fore wings, as in most (not all) South and Central American species, more falcate and elongated, and costa more arched, the wings being less short and broadly triangular in *A. io*, and hind wings more rounded and convex. Body and wings uniformly pale faded ochraceous yellow, with a slight olive tinge, almost a light fawn color. (It has a much bleached look, either the effects of the dry Arizona climate, or from long preservation in the insect drawers.)

Fore wings with no other markings or blotches than an oblique extradiscal narrow ochreous and brown line extending from the middle of the inner edge of the wing to the costa just before the apex. Discal spot irregular, with six dark irregular dots.

Hind wings of the same general hue, bright straw-yellow surrounding the black discal ocellus, which is centered by a white bent or curved line, with scattering blue scales sprinkled around it; the yellow is bounded by a distinct much curved black line, vanishing on the costal region and near the inner edge, which is pale roseate, beyond it is parallel with the outer edge.

Beneath, the wings are uniformly paler; there are no lines; the ocellus of the fore wings is formed of a broad black ring centered with white; that of the hind wings reduced to a small white spot, with a few dark scales around it. Abdomen pale ochreous above, with about four or five pink-red bands. Tarsi pale reddish.

In this species, which both in its larval and imaginal characters belongs to a different section of the genus from *A. io*, the two sexes are colored [nearly] alike. The fore wings are longer and more falcate than in *A. io*, and in coloration, unless it is the result of exposure to the light, though no more exposed than the rest of the group, it is another example of the bleaching process [to] which the heterocerous lepidoptera of so dry and hot climate as that of Arizona, with its intensity of sunlight and aridity of soil, is subjected. In coloration it somewhat approaches *A. viridescens* and *incisa* of Brazil, being nearly as pale, but it belongs, judging by the larval characters, to quite a different group from that represented by *A. viridescens*.

Expanse of fore wings, ♂ 66 mm.; ♀ 90 mm.
Length of a fore wing, ♂ 32 mm.; ♀ 48 mm.
Breadth of a fore wing, ♂ 18 mm.; ♀ 25 mm.
Length of hind wing, 25 mm.
Breadth of hind wing, 17 mm.
Ocellus of under side of fore wing, 7 by 5½ mm.; of hind wing, 7 by 7 mm.

[Egg and larva: Kunzé, Journ. N. Y. Ent. Soc., VIII (1900), pp. 201–205. Larval stages: Henry Edwards, Entomologica Americana, IV (1888), p. 62.]

Egg.—From Prescott, Ariz.; perfectly chalk-white. The eggs were received June 29 and hatched July 22–23.

Larva.—Stage I: Colors when first hatched; head black, body snuff-brown, of the same color as in *A. io*, finally becoming black. The tubercles are at first snuff-brown, becoming black. The hairs at the tip of the long tubercles are pale brown, like those on the head. August 2. Length 13 mm. The two pairs of lateral eversible sacs are not visible. Dull flesh colored. Head and body above, black; body dark snuff-brown below.

Geographical distribution.—Prescott, Ariz.

[AUTOMERIS PAMINA AUROSEA (Neum.).

Plate LXVII, figs. 8, 9.

The original description is as follows: "This is a splendid variation of the above-described insect, the head thorax and primaries being of a golden yellow color with a sprinkling of light rose-colored dust; the tuft, along abdominal margin of secondaries, of bright rose color, and the parallel band between the black semicircular line and exterior margin of bright purplish red."

In Dyar's List *A. boucardi* Druce, Biol. Cent. Am., Lep. Het., I (1886), p. 178, pl. 17, fig. 5, from Costa Rica, is given as a synonym, but I learn from Dr. Dyar that this is a mistake.

A supposedly authentic specimen of *aurosea* is figured by Holland, Moth Book, Pl. IX, fig. 6. This does not bear out Smith's statement (Proc. U. S. Nat. Mus., IX, p. 433) that *aurosea* is to *pamina* as *lilith* is to *io*. It appears from Dr. J. B. Smith's account that there exists a much redder variety of *A. pamina*, which is, according to Mr. J. Doll (litt. July, 1912), the genuine *aurosea*. Mr. Doll states that Holland's figure represents *pamina* proper. The *aurosea* form must be a constant one, as Mr. Doll says, "I have seen hundreds of them, and they are all like the type specimen."]

AUTOMERIS ZEPHYRIA (Grote).

Plate LIX, fig. 7; LXVIII, figs. 1, 2.

[*Automeris zephyria* Grote, Canad. Entom., XIV (1882), p. 215], Ann. and Mag. Nat. Hist., ser. 5, XI (1883), p. 52.

[Antennæ orange-brown; head and thorax deep brown; abdomen dorsally pink, anal segment fawn color; beneath pectus, abdomen and legs fawn color. Primaries deep brown with a white line at the extreme base of wings; from apex of wing to middle of inner margin a slightly concave white band extends, sharply defined outwardly, slightly diffuse on inner margin, averaging 1.5 mm. in width; at the end of the cell and resting partially on the white band is an indistinct ocellus, usually more or less defined by black scaling and with a small central white dot or dash; in the ♀ the whole ocellus tends to become obscured by white scaling. Secondaries, dark fawn color, pinkish at base and along inner margin, and with the central area orange-yellow; this yellow area is defined outwardly by a curved black postmedian line, parallel to outer margin and very slightly waved, not attaining costal margin, bordered outwardly with a whitish shade; the terminal area of wing is somewhat paler than the ground color, leaving a subterminal band of deep fawn color, which broadens gradually toward the anal angle; ocellus large, black, with a central area of blue-white scaling and an irregular comma-shaped white mark, which is occasionally lacking; the whole ocellus completely surrounded by the yellow scaling; a narrow terminal line of deep fawn. Beneath fawn color slightly tinged with pink; primaries with a prominent black, round ocellus with white center; secondaries with the central white mark of the ocellus repeated, the remainder of the ocellus, however, only showing indistinctly through from the upper side. Expanse, ♂ 59 mm., ♀ 63–75 mm. Described from two ♂ ♂, three ♀ ♀ in coll. Barnes, two pairs received from F. H. Snow, collected in the type locality, the third ♀ from Las Vegas, N. Mex.—J. McDunnough.]

[Snow's material was obtained in Gallinas Cañon, near Las Vegas.]

AUTOMERIS ZELLERI (Grote and Robinson).

[*Hyperchiria zelleri* Grote and Robinson, descriptions of American Lepidoptera.—No. 4; Trans. Amer. Entomol. Soc., vol. 2, 1868, p. 193.

The description by Grote and Robinson is as follows:

♀. Size large, form stout. Head and palpi rich dark brown; antennæ testaceous, a little slenderer than in allied species. Thoracic region, above, dark brown; laterally, at the insertion of the primaries, are arranged short whitish hair-like scales which form a spreading tuft. Abdomen, above, bright ochreous brown; beneath with under thoracic surface and legs, of a rich brown, a little paler than upper thoracic surface and head.

Wings full and large. Primaries arcuate along the costa; apices pointed but not produced; external margin evenly outwardly rounded. Basal third covered with rough or woolly dark brown scales; this portion of the primary wing is outwardly defined by a darker shade. These dark brown rough squamæ extend along the costal region to the apex, and intrude obliquely downwardly twice over the middle of the wing—firstly, obliquely and broadly from the costa

over the discal cross vein to the first m. nervule; this band is thrice regularly scalloped outwardly between the nervules and includes a white discal dot on the cross vein, situate just below the inception of the discocellular nervule; secondly, more narrowly and nearer the apices, the scales forming an even band extending downward to first median nervule at a point where the usual transverse line crosses the nervule. This transverse line is narrow and distinct, whitish, and is rounded at costa, not oblique and even, and joins the costal edge at a point considerably removed from the apex. The ground color of the median space is a frosted purplish brown, over which the dark costal scales down wardly intrude as above described. The dark scales extend again broadly and more diffusedly downward from the apex, bordering the transverse line externally and irregularly, widening over the median nervules to internal margin, and leaving the irregular terminal space of the wing of a pale frosted purplish brown, over which the nervules are marked with ochre.

Secondaries full and rounded. At base thickly clothed with long and very bright ochreous scales. A large black discal ocellus consisting of a broad blackish annulus surrounding a paler center, which contains a black pupil (the discal spot) containing a few white scales. Outside this ocelloid spot are two broad subequal *even* blackish bands, the outer the broader, and which traverse the wing from costa to internal margin. The pale dull ground color of the wing separates these bands and obtains beyond the outer band, while the even narrow terminal space is concolorous with that on primaries, being purplish brown, frosted with pale scales, the nervules marked with ochreous.

Beneath of a clear pale purplish brown. On the primaries the discal mark is seen and a blackish shade band indicates the narrow transverse line of the upper surface. Secondaries concolorous with primaries; there is a distinct white discal spot on the cross vein and a faint oblique dark shade band. The ground color of the wings has something of a dead pink tinge beneath; this is especially noticeable on the secondaries below the median nervure. The exerted veins on both wings beneath are covered with ochreous brown scales.

Length of primary wing (from base to apical angle), 73 mil. Length of body, 44 mil. Width of primary (from apex to internal angle), 50 mil. Length of primary (from base to internal angle), 44 mil.

This fine addition to our United States fauna differs from an allied tropical species determined as "*egeus*, Cramer sp." in the Berlin Museum, in the shape of the primaries which in that species are produced at apices, the external margin receding suddenly below them. It is also a rather larger, broader-winged, and slighter-bodied species. The narrow whitish transverse line of the primaries is *inwardly rounded superiorly to costa*. *Hyp. zelleri* is also distinguished by the outer rounded band of the secondaries above, being *even* along its external edge, whereas in "*egeus*" it is prominently scalloped; this latter character will also separate it from a more Southern form recently figured by Dr. Felder, who showed us his drawing while we were in Vienna.

Dedicated to Prof. P. C. Zeller, of Meseritz, the widely known and respected entomologist, whose writings on our subject need no mention of our earnest appreciation to enhance the value of his scientific labors. This dedication commemorates pleasant days we recently enjoyed with the professor at his home, during which our science was discussed with one of its fathers whose personal kindness and consideration to us merits our thankful recognition.]

[*Geographical distribution.*—"Texas," Kirby, Cat. Lep. Het., I, p. 777; "Mexico ?, Texas ?," Dyar. Bulletin 52, United States National Museum, page 73.

Dr Dyar (litt. 1912) has never seen a specimen.]

AUTOMERIS CORESUS (Boisduval).

Plate XX, figs. 3, 4.

[*Io coresus* Boisduval, Bull. Soc. Ent. France (3) VII (1859), p. 158.]

Larva.—Last stage: Length, 85 mm.; width of head, 6 mm. Closely similar to that of *A. illustris* in shape, general color and armature, and the lateral lines and colors of the abdominal legs. It differs only in the red spiracles being much smaller; in the lack of the abundant long white hairs, while the abdominal legs are less dark and red.

The armature of spines (tubercles) is almost identical; the spines and the long, slender spinules are well developed, pale straw-yellow, and of the same length and thickness as in *A. illustris*. The double dark brown lateral line incloses a yellowish one. There is a similar row of seven dark oblong patches on each underside of abdominal segments 2 to 8, each patch bearing yellowish granulations varying in size. On each side of abdominal segments 2 to 7 is a subdorsal row of six reddish-brown roundish spots, each situated between the dorsal and supraspiracular spines. On the outer side of the anal and also the other abdominal legs is a reddish patch, with pale or yellowish granulations. It is a very conspicuously marked larva, the bright red spots contrasting with the hue of the body.

Stage before the last: Length, 50 mm.; width of head, 5½ mm.

Differs from the full-grown larva only in the tuft-like spines having the spinules a little more spreading, but they are of the same relative length, thickness, and number.

All the markings, including the lateral line, the two subdorsal rows of red spots (the latter a little smaller), the suranal plate and abdominal legs and the pale head are of the same color.

Cocoon.—Large and loose, of the same size, shape, and color as that of *A. illustris*. Length, 45 to 60 mm.; diameter, 23 mm.

Pupa.—That of ♂ differs from ♂ of *A. illustris* in being much more coarsely granulated, the little warts not being arranged in lines as they are in *A. illustris* ♂. Length, 35 mm.; thickness, 14 mm.

Geographical distribution.—Buenos Aires (American Museum of Natural History, New York).

AUTOMERIS VIRIDESCENS (Walker).

Plate XX, figs. 5, 6; LIV, figs. 2, 3.

[*Hyperchiria viridescens* Walker, Cat. Lep. Het. Brit. Mus., VI (1855), p. 1303.]

Larva.—Stage III (?): Length, 40 mm.; width of head, 4 mm. The shape of the body and the armature is much as in *H. io*. Head and body black.

Spines short and close, radiating, and much as in mature *H. io* in general appearance, and quite different from the larva in the two last stages. All the tubercles (spines) are straw-yellow. Prothoracic dorsal spine as long as the head is wide, bearing about 16 spinules, the longest spinule about one-third (or a little more) as long as the spine itself. The dorsal spines on the segments behind are all of the same size and length, the spines radiating; second thoracic dorsal spines longer than any of the others, the longest or highest branch bearing four or five spinules. The median spine on eighth abdominal segment is about a third thicker than the others on each side; its original double nature is scarcely indicated.

All the legs, thoracic and abdominal, black. Spiracles white.

Larva.—Penultimate stage: Length, 70 mm.; width of head, 6 mm. Head shining black, body deep velvety black.

Spinules not now radiating, but vertical, forming a thin brush or tuft. Prothoracic dorsal spines as long as those on the segments behind, but slenderer, with fewer spinules. The relative size and thickness of the tufts themselves much as in the last stage. Spiracles white. It differs not so much in the proportions of the bundle of spines as that the spinules are rounder, not flattened, as they are in the fully grown larva, and the spinules radiate a little more.

[Described from material from Buenos Aires.]

AUTOMERIS LEUCANE (Geyer).

[*Gamelia leucane* Geyer, Samml. Ex. Schmett., III (1837?).]

[*Larva.*—Head larger than joint 2, flat before, rounded above, not bilobed; shining black, shagreened, with a few short, inconspicuous secondary setæ. Body cylindrical, tapering before and abruptly behind; coal-black, a little wrinkly shagreened and with a few sparse pale secondary hairs; spines light yellow. The spines are in four rows on joints 2 to 5; five rows on joint 6; three rows on joints 7 to 10; four rows on joint 12; a single dorsal and three other rows on joints 13 and 14. The spines are rather short, each with several long branches, tipped with small black points; the two upper rows of joints 2 and 3 are rather longer than the others, as are also the dorsal ones of 13 and 14; the subventral ones are small. Feet and leg shields shining black. Misantla, State of Vera Cruz, Mexico (W. Gugelmann). Food plant. Troena [=?].—H. G. Dyar, Proc. Ent. Soc. Wash., XIV. (1912), p. 55.]

AUTOMERIS JANUS (Cramer).

[*Attacus janus* Cramer, Pap. Exot., I (1775).]

[In *A. janus* the spine defense (of the larva) is carried to an extreme; the length of the profusely branching spines is 15 mm. to 25 mm., or twice the diameter of the body, and so abundant (are they) that the larva looks like a bunch of moss a few yards away; while the quantity of poison contained in these spines is so great that during the process of inflating the fumes which are driven off * * * are positively dangerous. * * *—O. W. Barrett,

Canad. Entom., XXXII (1900), p. 236.] [I have examined this species, the type of the genus, in the United States National Museum. The moths are very large, with the anterior wings pointed apically in the manner of *P. pamina*. The ocellus of hind wings is very large and has a lightning-like white streak. The sexes are not very different. Comparing the antennæ, venation, etc., I find no generic difference from *A. io*.]

AUTOMERIS BOUCARDI Druce.

Plate XX, fig. 2.

[*Automeris boucardi* Druce, Biol. Cent. Amer., Lep. Het., I (1886), p. 178. Costa Rica.]

[*Table of species of Automeris in the U. S. National Museum.*

By Harrison G. Dyar.

Automeris=Hyperchiria=Gamelia.

Fore wing with the outer line crenulate throughout.
- Ocellus of hind wing with white center, brown disk, outer plumbeous and black rings ..... *submacula* Walker.
- Ocellus of hind wing with black center, ocherous inner lunate ring, brown and black outer rings .. *aspera* Felder.
- Ocellus of hind wing black with white central spot or line and black powdering.
  - Disk of hind wing crimson to ocellus ..... *rubicunda* Schaus; Pl. LXXX, fig. 4.
  - Disk of hind wing yellow around the ocellus.
    - Fore wing yellow in the ♂.
      - Large; discal mark of ♂ usually pectinate; ♀ purplish or pinkish gray, the lines pale, distinct. *io* Fabricius.
      - Smaller; ♂ discal mark not or slightly pectinate; ♀ rosy pinkish, the lines usually faintly marked.
        - Fore wing with the outer margin full, rounded.
          - Marks slight; ♂ with outer line; discal mark subpectinate; ♀ nearly unmarked. *dandemon* Dyar; Pl. LXXVII, fig. 5.
          - Marks rather distinct; ♂ with discal mark outlined, shaded; ♀ with rather distinct marks. *colenon* Dyar; Pl. LXXVII, fig. 6.
        - Fore wing with outer margin straight, rather oblique ..... *melmon* Dyar; Pl. LXXVII, fig. 4.
    - Fore wing tan-color to rosy brown in ♂.
      - Larger; ♀ (where known) with discal mark dark, pale-outlined.
        - Fore wing of ♂ with the marks distinct ..... *lilith* Strecker.
        - Fore wing with the marks obliterate ..... *hebe* Walker.
      - Smaller; ♀ with discal mark large, dull ocher without outline ... *thyreon* Dyar; Pl. LXXVII, fig. 3.

Fore wing with the outer line crenulate near costa, straight below ..... *mendosa* Boisduval.

Fore wing with the outer line rigid throughout, not crenulate.
- Ocellus of hind wing without inner discolorous ring, black with central white line and powdering.
  - Disk of hind wing around ocellus tan-color.
    - Termen of hind wing tan or gray ..... *janus* Cramer.
    - Termen of hind wing brown ..... *larra* Walker.
  - Disk of hind wing yellow.
    - Outer line of fore wing oblique to apex.
      - Outer line of fore wing with light shade beyond more or less distinct.
        - Discal mark a ring with central dot, scarcely punctate or angled. *annulata* Schaus; Pl. LXXVIII, fig. 5.
        - Discal mark if a ring, punctate or angled.
        - Shade on inner margin of hind wing crimson.
          - Fore wing contrastingly shaded, pale shade beyond outer line broad, evident. *boucardii* Druce.
          - Fore wing smoothly shaded, the outer shade narrow, faint.
            - More contrasted, erect brown shade from costa to outer line distinct .. *melanops* Walker.
            - Less contrasted, this shade faint ..... *zozine* Druce.
        - Shade on inner margin of fore wing blackish ..... *jivaros* Dognin.
      - Outer line of fore wing dark with a light line within.
        - Outer line appearing dark.
          - Hind wing normal.
            - Abdomen crimson or crimson banded.
              - Fore wing pointed, the outer line ending close to apex.
                - Rosy rufous ..... *incarnata* Walker.
                - Dark gray, olivaceous or lilacine tinted ..... *cecrops* Boisduval.
                - Pale tan or slightly rosy ..... *pamina* Neumoegen.

Fore wing blunt, the outer line ending on costa before apex.
meridana Schaus; Pl. LXXIX, fig. 8.
Abdomen black banded.....*vomona* Schaus; Pl. LXXX, fig. 7.
Hind wing with broad discal area, the marginal marks crowded.....*castrensis* Schaus.
Outer line appearing white in a dark ground.....*zephyria* Grote.
Outer line of fore wing erect to costa at outer fourth.
No white at base of fore wing next to thorax.
Fore wing slightly pointed at apex; apex with a dark shade; discal mark dark-filled.
orestes Boisduval.
Fore wing square at apex, without apical shade; discal mark of separate points..*daudiana* Druce.
A white patch at joining of fore wing with thorax.
Termen mottled with light on lower half.....*surinamensis* Kirby.
Termen uniform.
Yellow disk of hind wing normal.....*pomifera* Schaus; Pl. LXXIX, fig. 7.
Yellow disk narrow, annular in ♂, expanded on one side in ♀.
innoxia Schaus; Pl. LXXVIII, fig. 6.
Disk of hind wing with the yellow reduced to a narrow ring about ocellus.
With white patch at base of fore wing.....*innoxia* Schaus.
Without such white mark.
Outer line of fore wing slightly curved, oblique, running to apex.
Yellow ring around ocellus broad.....*complicata* Walker.
This ring narrow.....*midea* Maassen.
Outer line erect, parallel to outer margin, pale.....*orneates* Druce.
Outer line angled below costa.....*convergens* Walker.
Outer line straight, very oblique, from before middle of inner margin to costa before apex.
flammans Schaus; Pl. LXXX, fig. 2.
Disk of hind wing rosy pink, orange, or red.
Outer line of fore wing oblique, running close to apex.
Disk of hind wing rosy; submarginal pale line of fore wing distinct.
macarsis Schaus; Pl. LXXX, fig. 3.
Disk of fore wing orange red; submarginal line of fore wing obsolete.
narania Schaus; Pl. LXXX, fig. 6.
Outer line of fore wing erect, nearly parallel to outer margin.
Outer line straight, dark with a little pale inner edging or none; discal mark normal.
montezuma Boisduval.
Outer line somewhat irregular, with pale yellowish outer edge; discal mark large, brown, angularly expanded.....*saturniata* Walker.
Outer line angled below costa.....*cruenta* Walker.[1]
Ocellus of hind wing with an inner discolorous ring surrounding the black center.
Discal area of hind wing tan, brown, or whitish.
Lines of fore wing dark.
Disk of ocellus of hind wing tan like the field.....*egeus* Cramer.
Disk of ocellus dark brown.
Disk of hind wing tan-color.
Hind wing brown at base or slightly pinkish.....*beckeri* Herr.-Schaeff.
Hind wing red at base.....*larra* Walker.
Disk of hind wing whitish, pale.....*postalbida* Schaus; Pl. LXXVIII, fig. 1.
Disk of hind wing yellow, broad, or reduced to a ring about ocellus.
Disk broadly yellow.
Dark margin of hind wing narrow, restricted, its inner edge scalloped..*saturata* Walker.
Dark margin of hind wing normal.
Outer line of fore wing from near apex to beyond middle of inner margin.
zaruma Schaus; Pl. LXXIX, fig. 1.
belti Druce.
Outer line of fore wing to beyond outer fourth of inner margin.
accuminata Maassen.
Yellow disk reduced to a ring about ocellus.
Center of ocellus eccentric, basal, with points on veins 4 and 5.
Fore wing with white marks at base next thorax.
Dark umber brown, lines of fore wing obliterate.....*arminia* Cramer.

[1] [*A. montezuma* is described from Mexico, *A. saturniata* from Bogota, and *A. cruenta* from Brazil.]

Tan color or light brown.
Light tan; ocellus of hind wing moderate.....*braziliensis* Walker.
Darken tan; ocellus of hind wing large.....*scapularis* Boisduval.
Fore wing without white marks at base.....*irene* Cramer.
Center of ocellus of hind wing concentric.
Fore wing square at apex; generally red-brown or tan.
Outer line of hind wing crenulate, black and yellow.
Lines pale or with pale edges, somewhat blurred.
Yellow on disk of hind wing generally diffused and spreading.
rubrescens Walker.
Yellow on disk of hind wing forming a neat ring.
Ocellus of hind wing with small black center filled or replaced by white.
♂ smaller, fore wing square at apex.....*cinctistriga* Felder.
♂ larger, fore wing less acute.
tamphilius Schaus; Pl. LXXVIII, fig. 7.
Ocellus of hind wing, especially in ♀, with large black center, often divided.
Disk of ocellus broadly light brown.....*tridens* Herr.-Schaeff.
Disk of ocellus dark brown, not contrasted.
nopaltzin Schaus; Pl. LXXVIII, figs. 2, 3.
Lines dark, narrow, distinct, without pale edges.
hamata Schaus; Pl. LXXX, fig. 1.
Outer line of hind wing without yellow filling, scarcely crenulate.
Fore wing with discal mark distinct, lines obsolete.....*jucundoides* Schaus.
Lines distinct, pale, dark edged, converging on inner margin.
maasseni Möschler.
Fore wing pointed at apex, generally olive brown.
Large species; dark shade beyond outer line distinct.....*nyctimene* Latreille.
Moderate sized; this shade obsolete.
Fore wing pointed at apex, the outer line running into the point.
leucane Hübner.
Fore wing more rounded at apex; outer line to costa before apex.
viridescens Walker.
Discal area of hind wing red, without yellow ring.
Outer line of fore wing with pale inner edge, more or less distinct
♂ brown or tan color.
Abdomen unicolorous.
Lines of fore wing in part at least dark.
Outer line well removed from margin at least below.
Gray-brown, marks relieved, lines convergent on inner margin.
coresus Boisduval.
Tan brown, marks little relieved, lines slightly convergent.
Red of disk of hind wing a little suffused with yellow, forming a trace of a ring about ocellus.....*randa* Druce.
Red of disk uniform, without perceptible yellow ring.
Center of ocellus of hind wing small, generally heavily white powdered.....*illustris* Walker.
Center of ocellus large, black, lightly white powdered.
parilis Schaus; Pl. LXXIX, fig. 3.
Outer line far out, near margin.....*moresca* Schaus; Pl. LXXVIII, fig. 4.
Lines of fore wing pale, contrasted.....*oblonga* Walker.
Abdomen dusky ringed.
Outer line of hind wing like submarginal and marginal, broad, shaded.
amanda Schaus; Pl. LXXIX, fig. 4.
Outer line blacker than the others, differentiated.....*banus* Boisduv.
♂ yellow, brown marked.....*junonis* Walker.
Outer line of fore wing contrasted, dark, narrow, no pale edge.
Ocellus of hind wing with small black center heavily white powdered.
curvilinea Schaus; Pl. LXXIX, fig. 2.
Ocellus with large black center, often triplicate, with white line and little powdering.
Smaller; abdomen unicolorous.....*melanops* Walker.
Larger; abdomen dusky ringed.....*liberia* Cramer.

Disk of ocellus of hind wing red or orange.
Fore wing blunt at apex, normal.
Ocellus of hind wing with white center.....*pyrrhomelas* Walker.
Ocellus with pink center.....*orodina* Schaus; Pl. LXXIX, fig. 6A.
Ocellus with black center.....*pygmaea* Schaus.
Fore wing of ♂ falcate, outer margin concave throughout.....*janeira* Westwood.
Fore wing pointed at apex, outer margin bulging below.
Ocellus of hind wing with a black central pupil.....*arguta* Boisduval.
Ocellus of hind wing with white center only.
Smaller; more rosy; marginal space of fore wing broader, pale-shaded, subterminal line relieved.....*irminia* Cramer.
Larger, not rosy, subterminal space more restricted and nearly unmarked.
Somewhat larger.....*episcopus* Boisduval.
Somewhat smaller.....*abas* Cramer.
Fore wing with subapical prominence on outer margin excavate narrowly below.
Disk of hind wing orange or yellow.....*orodes* Boisduval.
Disk of hind wing olive gray.
Fore wing with the lines diffused; ♂ without prominence on margin, small in ♀; a blackish subapico-submarginal spot in both sexes.....*vala* Kirby.
Lines of fore wing distinct; prominence on margin distinct; no subapical black spot.
Disk of ocellus of hind wing orange; median line of fore wing faint..*nausicaa* Cramer.[1]
Disk of ocellus brick-red; lines of fore wing all alike.....*plicata* Herr.-Schaeff.
Ocellus of hind wing cloudy, obsolescent, blackish, not distinct nor contrasted.
Basal area of fore wing contrastingly dark, edged by pale lobate inner line.....*maconia* Druce.
Basal area if dark not conspicuously edged.
Outer line with inner pale shading.
Larger, blackish powdery.....*myops* Walker.
Smaller, browner, markings not obscured by powderings.....*inornata* Walker.
Outer line dark, not relieved by pale shading.....*obscura* Schaus;[2] Pl. LXXX, fig. 5.]

COLORADIA Blake.

Coloradia Blake [Proc. Ent. Soc. Phila., II (1863), p. 279.]
Eudyaria [Grote, Mittheil. Roemer, Mus. No. 6].
Eudyaria Kirby, Syn. Cat. Lep. Het., I [p. 744].

Imago.—♂ and ♀. Head of moderate size; front rather narrow, scales hair-like, long, dense, uneven; eyes moderate. Antennæ as in *Hemileuca* and *Pseudohazis;* the joints are short, the vestiges of the distal pectinations varying in length (in *C. pandora* nearly three times as long as in *C. venata*); in ♀ [not described].

Palpi variable in length, either small, not distinct, not reaching the front (*C. pandora*), or longer, distinct, extending beyond the front and drooping; third joint not distinct, the hairs at the end being rather long (*C. venata*).

Body thick and hairy; abdomen thick and rather broad.

Fore wings rather narrow, costa straight, not much curved toward the apex, the outer edge much shorter than the inner. Hind wings rather narrow, the outer edge short and rounded.

Venation: [Dr. Dyar notes of *C. loiperda:* "Veins 6–7 of hind wing very variable, ranging from connate to long-stalked, even differing on the two wings of the same specimen." These are veins III_1, IV_1, of the present work.]

Markings: The wings of both pairs either with indistinct diffused broad basal and extradiscal bands (*C. pandora*), or none at all (*C. venata*), in which case the veins themselves are distinctly marked with darker scales than on the rest of the wing; a black round discal spot, or a small obscure irregular patch on both wings (*C. venata*). Antennæ pale yellowish in *C. pandora*, or dark (*C. venata*).

Larva.—[See under *C. pandora.*]

This genus is characterized by a much stouter body and narrower wings than in *Pseudohazis* or *Hemileuca*, with which it is related by its adult and larval features.

Geographical distribution.—A neogaeic genus, occurring in Buenos Aires and in the western United States from Colorado to the Pacific coast.

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[1] [According to Kirby, *A. nausicaa* is the type of *Hyperchiria.* He gives its range as Mexico to Brazil.]
[2] This is probably an *Hylesia* allied to *Micrattacus violascens* Maass. & Weym.

COLORADIA PANDORA Blake.

Plates XX, fig. 8; XXI, fig. 1; LIV, fig. 6; LXI, figs. 1, 2 (*pandora*), 3, 4 (*loiperda*), 5, 6, 11, 12 (*doris*).

Coloradia pandora BLAKE [Proc. Ent. Soc. Phila., II (1863), p. 279].

Imago.—Four ♂, one ♀. Body dark vandyke brown, with a roseate patch on each side of the collar, while the femora are clothed with roseate hairs.

Fore wings brown with gray scales; a diffuse indistinct band, situated midway between the base of the wings and the distal patch, but nearer the latter. An oblique broad diffuse indistinct slightly sinuous extradiscal band, beginning on the outer third of the inner edge, and ending on the outer fourth of the costa. The costal and outer edge darker than the rest of the wing; the fringe is white at the ends of the veins; a large round solid black discal spot. Hind wings paler, more translucent than the fore wings, with a smaller discal spot, and an extradiscal slightly curved diffuse line beyond, and a similar parallel submarginal line. Outer edge of the wings dusky and gray with venular marginal white spots; the inner edge roseate.

Under side of the fore wings suffused with roseate. In the ♀ no rose-colored scales on the inner edge of the hind wings.

Expanse of the fore wings, ♂ 80 mm.; ♀ 80 mm.
Length of a fore wing, ♂ 36 mm.; ♀ 39 mm.
Breadth of a fore wing, ♂ 18 mm.; ♀ 19 mm.
Length of a hind wing, ♂ 28 mm.; ♀ 28 mm.
Breadth of hind wing, ♂ 20 mm.; ♀ 19 mm.

Although not an especially variable species, it varies in the presence of the rose-red scales; in two males the roseate patch on each side of the collar is wanting; in one ♂ there are no rose-colored scales on the inner edge of the hind wings, and very few in another ♂.

A local variety occurs in Colorado, regarding which Mr. David Bruce writes me as follows: "Var. *doris*. This name was never published, I believe. Mr. Neumoegen proposed it for a small thick-winged dark form I took many of in Garfield County, Colo." [This was published as *doris* Barnes, based on one of each sex labeled "Colorado (Bruce)."]

[Another form is *loiperda* Dyar, Proc. Entom. Soc. Washington, XIV (1912), page 105. It is defined as "Similar to *pandora;* smaller, the hind wings whitish in ground and nearly without the red tint; fore wings more densely irrorated with white." Described from four males and one female from Colorado, the only one with exact locality being from Glenwood Springs (W. Barnes). I possess a female from northern New Mexico (probably Santa Fé or vicinity), which resembles *loiperda*, although the hind wings have the anal margin broadly suffused with rosy, and the anterior wings lack the distinct subapical dusky marks. On comparing it with the types of *loiperda* I find that it is certainly distinct, differing especially by the dusky hind wings with strong pink color basally, and the lack of well marked white spots on fringe of hind wings. It seems not to differ from the tattered female cotype of *C. lois*.]

Egg.—Rather large, slightly flattened, spherical, surface of the shell smooth under a lens; shell pearl-colored, rather thin; the sutures of the larva visible through it. Length 2.5 mm.; breadth 1.8 mm. The eggs were received at Brunswick, Me., July 26, and hatched out August 26, the larvæ beginning to eat through the shell, seven appearing by 10 a. m. August 27, while some hatched as late as September 1. [See also Henry Edwards, Entomologica Americana, IV (1888), p. 61.]

Larva.—Stage I: Length 5 mm. Head large, a little wider than the body, smooth shining jet black, the latter rather short and thick, of the same general shape as in *Hemileuca*, slightly tapering toward the end. The body is at first honey-yellow, as are all the spiniferous tubercles at first, gradually becoming darker. There are six prothoracic spines, the two median dorsal ones on this and the second and third thoracic segments being rather deeply forked, and the single seta arising from each tubercle is finely spinulose, and nearly twice as long as the spines themselves. As the body darkens the tubercles remain pale, as also the suranal plate, and all the abdominal legs. The thoracic legs are black, though at first honey yellow

on the inner side. The median spine on the eighth abdominal segment is forked, and of the same shape as those on the thoracic segments. The longer tubercles with their setæ are about as long as the body is thick. Head with a few long whitish hairs. The spines all differ from those of *Automeris io* in sending off but a single very long seta, and there are short stout ones at the base of the long seta; they differ from those of *Hemileuca maia* in the same way. The generic larval characters thus appear in stage I.

After eating a while they all (five or six of them) marched off in Indian file. In about three or four hours after escaping from the egg they had all turned dark livid greenish, the body including the tubercles and anal legs, but the middle abdominal legs were still dark honey-yellow. In a few hours after the entire larva becomes black, except the whitish hairs and the middle abdominal legs, which are blackish and dark yellowish, all the tubercles being black.

Habits.—The females deposit their eggs on the trunks of the pine and sometimes aspen, or any other tree they happen to be on, late in the summer at Fort Klamath, Oreg. In the autumn of 1896, Mr. Cunningham found a batch of eggs on a living pine tree about 80 feet from the ground, late in the autumn. Mr. C. A. Wiley writes me that the eggs hatch in June, at Miles City, Mont.

[*C. lois* Dyar, Proc. Ent. Soc. Washington, XIII (1911), p. 89, was based on material collected by C. A. Wiley at Miles City, Mont. The types of *lois* are figured, but Dr. Dyar now considers it identical with *C. doris*.]

This moth is common at Fort Klamath in certain years. In 1892, Mr. B. L. Cunningham writes me, they were abundant, and up to that year "they had appeared regularly in numbers every other year," but after that time they were very rarely seen. The young larvæ are very restless and in the absence of food travel about in Indian file.

Food plant.—According to Mr. Burton L. Cunningham, the larvæ feed on the needles of the "yellow pine." They refuse the leaves of any of the commoner deciduous trees.

Geographical distribution.—So far as I can learn it is most abundant at Fort Klamath, in southern Oregon (Cunningham); also a variety of it in Garfield County, Colo. (Bruce); Salem, Oreg. "I have never seen or heard of it at Seattle" (Prof. O. B. Johnson in litt.). It has also been collected by Prof. F. H. Snow in Gallinas Canyon, N. Mex. (Cockerell in litt.). [Prof. Robert H. Wolcott writes (litt. December, 1912): "While in Sioux County, Nebr., a year ago last summer, during the last week of August, I picked up a dead specimen of *Coloradia pandora* in fair condition. It was lying on the ground at the bottom of Monroe Canyon, beneath a dense clump of box elders and elms. On August 12, this year, Mr. Ralph Dawson took another specimen in the same canyon in fine condition."]

[Subgenus EUDYARIA Grote.]

[Dr. Dyar has abstracted the pertinent parts of Grote's original account, as follows:

Rippen IV_2 and IV_2 sind nicht gegabelt aber gesondert.....*Agliidæ.*
Rippe III_1, entspringt oberhalb des Radius.....*Automerinæ.*
Vorderflügel am Aussenrande ganz.
Hinterflügel ohne Augenflecke.
Obere Kammreihe der Fühlhörner des ♂ ist weniger als halb so long wie die untere Reihe...*Eudyaria.*

In the text he says: "Die Raupe der südamerikanischen Art *Eudyaria venata* zeigt auf XI und XII die Tuberkel I verschmolzen. Das Afterschild ist glatt. Vorhanden sind drei Reihen dornähnlicher Auswüchse von gleicher Länge, mit denen von *Automeris* übereinstimmend. Diese Gattung benenne ich nach meinem Freunde Dr. Dyar * * *."]

[On a small scrap of paper, evidently of later date than the account given below, Dr. Packard has written:]

Eudyaria is probably a good genus. Palpi and venation differ from *Coloradia*. [Packard's figures represent the male of *C. pandora* and the female of *Eudyaria venata*. My female *Coloradia*, from New Mexico, differs from the figure of ♂ *pandora* in the hind wing, III and IV

(revised nomenclature) being united (stalked) for some distance beyond the cell. The venational differences between the two genera or subgenera may be expressed as follows:

Fore wing with III_2 well developed; hind wing with III and IV separating beyond the cell, either at a point with IV_2 or farther on ..... *Coloradia.*

Fore wing with III_2 absent; hind wing with III and IV separating before the end of cell, the upper corner of which is not angular ..... *Eudyaria.*

However, Dr. Dyar, having a good series of *Coloradia* (*C. loiperda*), finds that veins III and IV of hind wing are very variable, ranging from connate to long-stalked.]

COLORADIA VENATA (Butler).

Plate XX, figs. 7; LIV, figs. 7, 8.

[*Dirphia venata* Butler, Proc. Zool. Soc. London, 1871, p. 83.]
Eudyaria venata Grote. [It is the type of *Eudyaria* Grote, Mittheil. Roemer Mus., No. 6.]

Imago.—One ♂, one ♀. A larger stouter species than the North American one. Body with a thicker, denser vestiture than in *C. pandora*. Uniformly vandyke brown; the wings with no bands; but the veins are covered with dark brown scales and are very distinct. The wings, especially those of the hinder pair, are darker along the outer edge. The discal spot is small, obscure, a little paler than the surrounding part of the wing. The hind wings are a little larger and sienna brown or tawny in ♂, in ♀ black; discal spot not visible beneath. There are no roseate scales in this species.

Expanse of the fore wings, ♂ 94 mm.; ♀ 100 mm.
Length of a fore wing, ♂ 46 mm.; ♀ 50 mm.
Breadth of a fore wing, ♂ 24 mm.; ♀ 26 mm.
Length of a hind wing, ♂ 36 mm.; ♀ 39 mm.
Breadth of a hind wing, ♂ 25 mm.; ♀ 25 mm.

This species differs from our American species by its much larger size, the stouter body, the absence of lines, and the dark veins contrasting with the lighter brown ground color of the wings. It is an example of the tendency in South American representations of this genus and *Meroleuca* to have dark thickly scaled veins contrasting with the less densely scaled surface of the wings ground, rendering the color lighter, or with a tendency to translucence, a tendency carried out to an extreme in the tropical and subtropical genera *Heliconisa* and *Pseudaphelia*. I have compared my specimens with the examples so named in the British Museum.

Geographical distribution.—This species inhabits Buenos Ayres.

Larva.—Last stage: Length 90 mm.; width of head 8 mm. Head yellowish brown, smooth, and shining. Body cylindrical, as usual dark brown. The tuft-like spinulate tubercles are much slighter and slenderer than in *Automeris viridescens*, the spinules being long and very slender, cylindrical, and they ascend, not spreading out much; they are somewhat reduced as in *Coloradia*.

The prothoracic and other dorsal tufts as in *A. viridescens*, but slighter and slenderer. There are about the same number of spinules on each spine: 15 on the dorsal prothoracic segment, 20 on the dorsal second thoracic segment, 16 to 20 on the dorsal third thoracic segment, 20 on the dorsal first abdominal segment, 24 (12 on each side) of the median spine on eighth abdominal segment. The tip of each spinule is acuminate, dark. The suranal plate is just as in that of *A. viridescens*. The legs, both thoracic and abdominal, are all dark.

Pupa.— ♀, ♂ of nearly same shape as in that of *Automeris viridescens*, but the surface smooth, not granulated or rugose; cremaster conical, simple, without hairs; that of ♀ rather larger and stouter than ♀ of *A. viridescens*. Length ♂ 40 mm.; thickness 15 mm.; ♀ 40 mm., thickness 17 mm.

Buenos Ayres (Amer. Museum of Natural History, New York).

HEMILEUCA Walker.

[*Hemileuca* Walker, Cat. Lep. Het. Brit. Museum, VI (1855), p. 1317.]

Imago.— ♂ and ♀. Head moderately broad, more or less hairy and bushy. Eyes moderately large. Antennæ well pectinated to the end, the pectinations curved in the manner characteristic of *Coloradia* and *Pseudohazis;* antennal joints short so that the pectinations are closely crowded; in ♀ the pectinations are distinct, about twice as long as the joints, even on each side, and thick at the base, ending acutely; those of the outside are a little longer than those on the inside.[1] Palpi short, feeble, depressed, scarcely visible, as their scales are with difficulty distinguished from those of the lateral region of the front. Thorax moderately stout and quite hairy. Fore wings with the costa straight, very slightly concave near the middle; the apical region slightly turned up; outer edge short, much shorter than the inner. Hind wings with the costa straight, also slightly concave along the middle; apex moderately pointed; outer edge quite evenly rounded; inner edge straight or slightly convex.

Venation: [Pl. LII.]

Abdomen of ♂ broad and flattened, with a spreading, often scarlet, tuft at the tip.

Markings: Ground colors usually (*H. maia* and *juno*) dark or black-brown, with a broad median white band crossing wings of both pairs. Discal spot a pale or white crescent, usually well marked, and one either nearly as large on the hind wings (*H. maia*) or obsolete (*H. juno*).

HEMILEUCA ELECTRA Wright.

Plate LXII, figs. 10, 11; CXII, figs. k–p.

[*Hemileuca electra* Wright, Papilio, IV (1884), p. 19; Watson, Entom. News, XXIII (1912), Pl. VII. fig. 1, ♀.]

♂, ♀. Near *H. yavapai;* fore wing same shape, apex, etc.; hind wing shorter, more rounded; ocellus same, white on a black field, beside broad extradiscal [band] nearly reaching outer edge; three white patches, two in middle of wing and one along basal half of discal area. Hind wing in ♂ dark, suffused with salmon flesh color; in ♀ whole wing salmon except a broad marginal black band; ocellus large, entirely black. Beneath, wings mostly salmon, in ♀ still clearer. San Diego [California].

[Ab. *rickseckeri* Watson, Entom. News, XXIII (1912), p. 97, Pl. VII, fig. 1a, ♀. Fore wing above wholly jet black except for the discal spot, a faint diffused white streak widening from base to halfway up the cell and a faint diffused whitish spot on hind margin divided by the submedian nervure. The nervures submarginally penciled with the faintest possible traces of white. Hind wing above with the costal margin heavily outlined with black extending to the large oblong black discal spot, which has a distinct transparent line within. Outer margin heavily outlined with black which runs up the nervures as far as the discal spot. Both wings below have the costa and outer margins broadly suffused with black. No apical white suffusion. Body less heavily banded with white below. San Diego, Cal. This is a highly melanic form, and the name must be applied to very dark examples of *H. electra,* few of which will probably agree in every detail with the description.]

[The species is quite variable. In Watson's figure of the female the submarginal light band of anterior wings is very strongly developed, broad, quinquedentate on outer side, and the subbasal light triangle is large and well developed. In a female (also from San Diego) in the United States National Museum these markings are faintly indicated, the submarginal pale band being represented only by a series of elongated marks, traces of which are also present in the type of ab. *rickseckeri.*]

[1 Dr. Packard intended to rewrite the account of ♀ antennæ.]

HEMILEUCA JUNO Packard.

Plate XXIII, fig. 6; LII, fig. 6; LXIII, figs. 3, 4; LXVII, figs. 3, 4.

Hemileuca juno PACKARD [Rep. Peabody Acad., IV (1872), p. 87. Kirby gives the date as 1871, but it was in the Peabody Report for 1871, published in 1872].
Hemileuca yavapai NEUMOEGEN [Papilio, I (1881), p. 172].

Imago.—Two ♂, two ♀. The male differs from *H. maia* ♂ in the head not being so roughly hirsute, and the antennæ are dark brown, not black. In ♂ and ♀ the fore wings are a little more pointed at the apex, and the inner edge is not so full and convex. The white band only reaches to vein II. The hind wings are less rounded at the apex; it is also a smaller species.

[Dr. Packard's original description was as follows:]

Hemileuca Juno, n. sp., two ♂, one ♀. Similar in its form to *H. maia*, but without the white band on the hind wings. Antennæ reddish; pectinations darker. Body dark brown; reddish hairs on under side of head and base of legs, not so dark, however, as in *H. maia*. Hairs on prothorax whitish, those on metathorax forming a transverse band of a deeper red than on end of abdomen. Scattered gray hairs on the thorax. Both wings uniformly dark brown; fore wings crossed by a broad diffuse white band, broken up into intervenular spots; it widens on the subcostal region, touching the costal end of the discal spot, and does not reach the costa. Discal spot hyaline, regularly crescent shaped. Hind wings with a few white scales beyond the discal spot, the latter minute, obscure and surrounded with a roundish, blackish cloud. Beneath, the whitish band appears most distinct toward the costa. On hind wings there is a round white patch beyond the discal dot, and another between it and the costa. Discal dot more distinct than above on both wings, especially the hind pair, and forming a white dot with a straight hair line running through it, while the round dark cloud inclosing it is more distinct than above. Abdomen clothed above with dull reddish hairs, with brighter red hairs on the three terminal rings.

Length of fore wing, ♂ 1.15; ♀ 1.25; of body, ♂ 0.85; ♀ 1.05 inches.

Border of Arizona and Sonora (Dr. Edward Palmer).

H. hera is said by Harris to be yellow, and seems to be a larger species than *H. juno*.

[Nuemoegen said of *H. yavapai:* "Similar in its form to *H. juno* Pack. and *H. diana* Pack., but is readily distinguishable from both by the glaring red abdomen of the male, and the black abdomen of the female. Besides, *H. yavapai* has a white subcostal line, and other peculiarities, which do not agree with *H. juno*." Dr. Packard, however, compared *H. juno* with the description of *yavapai*, and found them "just the same!" He also left a note on the variation, as follows:]

H. yavapai varies from Neumoegen's type male and female; (*a*) in white band of fore wing being wider behind, but hind wing black; (*b*) white band on fore wing very wide, and a similar white band on hind wing, not reaching costa or hind edge. A white discal narrow spot is present or absent.

Geographical distribution.—It occurs with *H. nevadensis artemis* Packard in the Mesilla Valley, N. Mex., "Middle Sonoran zone" (Cockerell).[1] [Arizona; Sonora; Kirby, Cat. Lep. Het. I, p. 784. Mexico; Arizona; Dyar, List N. Am. Lep. p. 74. Represented in coll. Barnes from Arizona, one ♂ (H. K. Morrison); Yavapai, Ariz., two ♂; Arizona, one ♀; Christmas, Gila County, Ariz. (Lusk), one ♀.]

[*Larva.*—Henry Edwards, Entomologica Americana, III (1887), p. 167, gave the following description, as *H. yavapai:*

Body velvety black, beautifully irrorated with yellowish-white dots. Head reddish brown, with deep channel on the crown and bearing numerous tawny hairs. Second segment with two wine-red tubercles in front, and on the anterior edge is a fringe of tubercles, bearing pencils of black hairs. The segments are divided by a transverse dull orange band, bearing a black bar, and there is a double dorsal interrupted whitish line, running the whole length of the body.

[1] The *H. juno* recorded by Townsend, Canadian Entomologist, 1892, p. 199, is *H. artemis*.

All the segments from No. 2 bear each six tubercular processes crowned with a pencil of black spines. The under side is honey-yellow; the feet and abdominal legs red at the base, the other joints black. Length 60 mm.]

HEMILEUCA MAIA (Drury).

Plate XXI, figs. 2, 3; XXII; LII, figs. 1, 2; LX, figs, 12, 13; LXVIII, fig. 11.

[*Attacus maia* Drury, Ill. Ex. Ent., II (1773), pl. 24, fig. 3.]
[*Bombyx proserpina* Fabricius, Syst. Ent. (1775), p. 561.][1]

Imago.—Fifteen ♂, four ♀ (and many others observed). Head, body, and antennæ of a rich velvety deep brown-black, collar white, tips of femora reddish.

The fore wings vary a little in the obliquity of the outer edge, it being usually quite oblique and the apex turned up. The fore wings are black-brown, with a median white band which is either wide and inclosing the discal spot, or narrow and only partially surrounding it. The line begins at the inner angle of the wing or within the angle on the inner edge, and ends before quite reaching the costal edge.

In some examples (one from Colorado) the white band is so wide as to leave only the base and outer edge of the wing black, thus approaching vars. *nevadensis* and *artemis*. Discal spot black, often subhyaline, and inclosing a curved or bent linear white spot varying somewhat in width and shape.

Hind wings as in those of anterior pair; where the white band is very wide on the fore wings it is so on the hinder pair. In one extreme the band is very narrow, interrupted by the ocellus and irregular in width, in others it is wider than the width of the [band of] fore wing. In one ♂ [ab. *lintneri*] captured at Albany, N. Y. (fig. 11, Pl. LXVII), photographed by the late Dr. Lintner, there is no white band on the fore wings; the ocellus is distinct, but on the hind wing a white band incloses the ocellus. The ocellus of the hind wing is more variable than in the fore wing; in one example it is very much reduced in size, and the linear white line within it is minute. Beneath, the wings are marked as above.

The smallest individual in my collection is from Intervale, N. H. (Glover Allen).

Habits.—In Providence one was flying October 15, on a warm sultry day. Also a male flying on an exceptionally warm day, at Rehoboth, Mass., October 12, 1901.

Prof. J. M. Aldrich writes me as follows regarding the habits of *H. maia* in Brookings, S. Dak., under date of September 21, 1891: "I send you to-day a package containing two lots of eggs of *Hemileuca maia*. I have hatched over a dozen of the moths in the last week. They pair and lay very soon after emerging. The larvæ feed on our commonest wild willow which grows along the streams (*Salix longifolia*)."

[The following data are from an article by Dr. J. A. Lintner:

Metamorphic periods.—For convenience of reference and comparison, the periods required for the several changes embraced in the transformations of *H. maia* are herewith tabulated:

	Days.
From hatching to first molt	8
From first molt to second molt	7
From second molt to third molt	9
From third molt to fourth molt	8
From fourth molt to fifth molt	13
From fifth molt to maturity	6
From maturity to pupa	5
From pupa to imago	58
Duration of larval state	56
Duration of papul state	58
From the egg to the imago	114

Prolonged pupation.—Much the larger portion of the pupæ of the above colony survived the winter. On the following June 4 another moth emerged, and thence to July 4 five additional ones appeared. An examination of the pupæ

[1][Abbot and Smith, Nat. Hist. Lep. Ins. Georgia, vol. I (1797), p. 99, describe and figure this species as *Phalæna proserpina*. It is represented as feeding on *Quercus rubra* var. *ambigua* Solander MS., a plant which is not the true *Q. rubra*, but has the leaf form of *Q. marilandica*. Sudworth has referred it to *Q. digitata*, but it does not appear to belong there.]

a month or two thereafter showed the remaining ones to be dead. The great fatality was undoubtedly the result of their indoor confinement under unnatural conditions.

Observations appear to indicate that the insect passes the winter mainly in the pupal stage, and that only a few moths emerge in the autumn of its first year.

Habits of the moth.—This moth is one of the few species that may be seen abroad during the daytime. I have seen it upon the wing at Center, N. Y., at midday of September 19, and in October. Its flight is peculiar, being rapid, in a direct line for a short distance, and then suddenly dropping to the ground and hiding; so that it is almost impossible to discover it, although the place of descent may have been carefully noted.

In the breeding cage the moths manifested a degree of restlessness in marked contrast with the notable repose of nearly all of the *Bombycidæ*. They were disinclined to accept of any provision made for the suspended position required for the expansion of their wings after emerging from the pupa. After their wings had fully expanded, usually within an hour, they commenced traveling over the sides of their cage with such a continual fluttering that, unless they were at once removed and pinned, the delicate scales were rubbed from their wings, and their beauty seriously marred.

Rarity.—The moth is quite rare in the State of New York. It had not been taken by me during a period of 15 years' collecting. The number of its egg belts occurring at Center, without search having been made for them, would indicate a greater abundance. Doubtless, its social habit in its earlier stages exposes it to destruction. On one occasion I observed one of the carnivorous bugs, *Podisus modestus*, in the midst of and feeding upon a small company of the larvæ, with one impaled on its proboscis. The original number of the brood (110, as indicated by the egg belt) had been reduced to 22, and in two or three days the last one would doubtless have been appropriated by the intrusive guest of the colony.

Geographical range.—This insect, although not abounding in any locality, is distributed over a large portion of the United States. It extends from Maine southwardly, through each of the seaboard States, to Georgia; and westwardly, through Ohio, Indiana, Illinois, Missouri, into Kansas; and probably onward, as a pale variety of it has been described from Nevada as *H. nevadensis*.—J. A. Lintner.]

[The records of the United States Department of Agriculture give the following localities for *H. maia:* New York (West Point); Massachusetts (Marshfield); Ohio (Dayton); Illinois (Richview); Indiana (Medaryville); Wisconsin (New Lisbon); Oklahoma (Glenwood); North Carolina (Black Mountain); Georgia (Athens)].

[*Pupation.*—When ready to change to pupæ the larvæ of *H. maia* enter the ground and make their way almost or quite to the bottom of the cage. They do not spin any cocoon, nor inclose themselves in any way, but change to naked chrysalids. The latter are of the same dull brown-black color and roughened surface as those of *Automeris io*, but they are proportionately much more slender and elongate.—C. V. Riley, notes at United States Department of Agriculture.]

[*Larva.*—The following appeared in Proc. Amer. Phil. Soc., XXXI (1893), p. 171.]

Stage I compared with that of Automeris io.—In this stage *maia* is very similar to *io;* only the bifid dorsal tubercles, or spines, have shorter branches, the spines themselves being a little shorter, while the longest bristle is longer, the other bristles arising from the end of the spines being fewer, indeed, only one, instead of three or four, as in the abdominal segments of *io*. The medio-dorsal spines on the eighth and ninth abdominal segments are much shorter and with a shorter fork, but with as long or slightly longer bristles arising from the forks. The larvæ of the two forms are of the same size.

Stage II (or III?).—Maia in what appears to be the second stage differs from *A. io* in its second stage in having much longer dorsal spines, with very much longer spinules. *Thus the generic characters appear in the second stage, as in A. io.*

[*Larva.*—Color, purple-black, covered with small pale yellow dots. Wide yellow band, dotted with short black lines runs along the stigmatal region. It is covered with black compound spines and tufts of bristles. On the first segment there are eight compound black spines, four on each side; on the second, there are also eight, the two on the back springing from a bunch of short black bristles. On the third, fourth, and fifth segments there are three compound spines on each side and two tufts of short bristles on the back, yellowish brown on the outside and black in the center. On the sixth, seventh, eighth, and ninth segments there are but two compound spines on each side with the two tufts on the back; on the tenth segment there are again three spines each side with the tufts, on the eleventh two spines, and on the twelfth there is no tuft of bristles, but seven spines, three on each side and one on the back. Head, chestnut-brown, cervical shield of the same color. Thoracic feet black, prolegs chestnut-brown. Ventral region same as the rest of the body, but somewhat paler. Length, 2½ inches; diameter, ⅓ inch. Feeds on the willows; prefers scrub willow. Found early in July.—C. V. Riley, notes at United States Department of Agriculture.]

[Mr. T. Pergande records in the books of the Bureau of Entomology that on August 2, 1889, two larvæ were received from G. H. Kruschke, Denster, Wis., reported as feeding on cranberry. They resembled *H. maia*, but appeared to differ in the shorter, barbed spines and darker color of the body. The ground color dorsally was dull black or very dark purplish black, with a much interrupted white mediodorsal stripe, divided along the middle by a black line, a much interrupted subdorsal white line and a broad whitish lateral stripe, inclosing the stigmata. Stigmata, pale buff with black annulus. Warts, dark red, those of dorsum somewhat paler. All branched spines and those on warts just above and below stigmata, black, tipped with white, those of the two dorsal rows orange tipped with black. Head, reddish brown. These larvæ did not produce moths, but Mr. Kruschke sent two pupæ "which he found in the dams, which no doubt belong to this species." The pupæ were remarkable in that the cremasters of both were without a trace of hooked spines, which are so strong and conspicuous in *H. maia*. They both produced crippled moths, which Mr. Pergande could not separate from *maia*. The specimens were also examined by Dr. Dyar.][1]

HEMILEUCA MAIA var. LUCINA Henry Edwards.

Plate LX, figs. 10, 11.

[The original description of *lucina* (Ent. Amer., II, p. 14) is as follows: A form occurring in Maine, and probably in other of the northern portions of our continent, which appears to deserve at least a varietal name. It is intermediate between *H. maia* and *H. nevadensis*, having the primrose band uniformly broad on the primaries and including the discal ocellus, and that of secondaries always wider than in any examples of *H. maia* seen by me. This band, too, is of rather different shape, and invariably reaches the posterior margin farther from the anal angle than is the case with *H. maia*. The wings, too, are much more transparent than those of the common form, and in some cases appear to be almost denuded of scales. I have during the past summer examined upward of 300 specimens of *H. maia*, many of which were raised from the egg, but though varying considerably among themselves, in the width and density of the band, I have seen none that I could not very readily separate from the form now under notice. My specimens (3 ♂, 2 ♀) are all from Norway, Me., and from near Bangor, Me.]

[The records of the United States Department of Agriculture indicate its occurrence at Aweme, Manitoba, where three males were collected by Mr. Norman Criddle. A female in the National Museum is labeled Colorado; it is from the collection of H. S. Burnett. Dr. W. T. M. Forbes states that *lucina* occurs at Worcester, Mass., and West Swanzey and Fitzwilliam, N. H. He has never seen *H. maia* as far north as these New Hampshire localities, nor at Worcester, though it occurs in eastern Massachusetts.]

[Dr. Packard examined the types and made the following notes:]

Five examples, all uniform. A good local variety. Expanse of fore wings ♂ 50, ♀ 55–62 mm.; white band very wide, as in *nevadensis*, but dark part of wing paler and more hyaline than in *nevadensis*, so that the difference in hue between the middle and outer edge of wing is much less marked than in *nevadensis*. It is smaller than any of the other specimens of *maia*, *nevadensis*, or *californica*.

[1] [There is considerable confusion, perhaps the result of local variation, as to the true larva of *Hemileuca maia*. The type locality is New York, and the northern larva, as it occurs in the collection of the United States National Museum, and as described by Reiff, is almost wholly black. The dorsum is dusted irregularly with pale yellow dots, but they have no decided tendency to gather and fuse into a pale stigmatal band. The head is deep red-brown, and the dorsal tubercles show only a little red at the base, the whole effect, whether from front or side view, being a black larva. The food is oak. In the Southern States, as figured by Abbot on Plate 50 of the *Lepidopterous Insects of Georgia*, it is much paler, but strongly variable. One of his figures represents a dominantly yellow larva, with a black subdorsal stripe, the other has a dark ground color, but the yellow dusting is evidently heavy on the dorsum, and on the incisures and in the broad stigmatal band occupies most of the surface. The subdorsal spines are reddish in both forms, as well as the head and the feet in the figure that shows them. The food is oak as before. The lighter of these two larvæ must have been closely similar to that of *H. nevadensis*, showing a likeness to the Colorado form, that is paralleled by the presence in both localities of the red female of *Automeris io*. The darker form is represented in the National Museum, and except for its larger size is almost exactly like *H. lucina*. The larva of *lucina* is of the black form, but is distinguished from the most northern specimens of that form by the fact that the yellow dotting is much stronger on the sides, forming more or less distinct stigmatal bands. Similar larvæ of *maia* are to be expected, but they should occur much farther south than the limit of *lucina*, as the typical black form ranges south to Washington, D. C. In the West this hiatus is likely not to exist, but here the adults are strikingly different, as *lucina* is unchanged in Colorado, while the *nevadensis* form of *maia* already appears in Nebraska. However the species may be found to intergrade here. Caterpillars should be collected and moths bred from them in the intermediate district, wherever *lucina* and *maia* are likely to occur together, as in southern Canada, and also where the northern and southern larvæ of *maia* meet, probably in Virginia or the Carolinas, and west to Colorado. Wm. T. M. Forbes.]

[Reiff, Psyche, 1910, pp. 30–31, has described two forms of *lucina* with the following characters:

Ab. *obsoleta* Reiff. Anterior wings with the white band more or less obsolete.

Ab. *lutea* Reiff. Wings grayish, the light band cream yellow instead of white. (The Latin diagnosis says "fascia lutea," which is rather misleading.) Mr. Reiff informs me that the type locality of these two aberrations is Raymond, N. H.

Reiff also reaches the conclusion that *H. lucina* is a valid species, not a variety of *H. maia*. He supports this view by the following pertinent facts:

(1) The larvæ and pupæ differ. *H. lucina* larvæ are, like those of *maia*, black in the youngest stage, but distinguished by "a strong brilliancy, best compared to black stove polish." The older larvæ are exactly like those of *maia*, except that they have "a sharply defined white stripe above the feet," which is absent or faint in *maia*. The size is less than that of *maia*. The cremaster of the pupa "is composed of about 25 strong brown spines with curved apices."

(2) No transitional forms are known.

(3) *H. maia* feeds on oak, while *H. lucina* feeds on meadow sweet.

(4) The young larvæ of *lucina* are gregarious, forming large clumps on the twigs of the food plant, while those of *maia* sit next to one another, in rows across the leaves.

(5) *H. maia* pupates normally in the ground, while *lucina* pupates (still without any cocoon) between dried leaves.

(6) Both occur in the same localities; where, when *maia* males first emerge, only females of *lucina* are present; the flying period of the two overlapping in the latter part of September; nevertheless, no hybrids have ever been seen.]

HEMILEUCA MAIA NEVADENSIS (Stretch).

Plates XXIII, figs. 1–5; LII, figs. 3–5; LX, figs. 14, 15; CXIII, figs. 4, 5.

[*Hemileuca nevadensis* STRETCH, Zyg. and Bomb. N. Amer., 1 (1872), p. 108, pl. 4, fig. 10.]

In var. *nevadensis* (Stretch) from California the basal quarter of the fore wings and the outer edge is black, all the rest of the wing is white in both wings except the costa. The ocellus (eastern form) varies much in size, and on the hind wings differs from that of *H. maia* in being much reduced in size, roundish or narrow and irregular, and without the central white line. On the thorax of eastern *maia* are two reddish tufts near the base of the hind wing, one on each side. Abdomen of ♂ black, with gray scales in patches on the sides beneath, and often above; at the end is a bright Indian red spreading tuft. In ♀ the abdominal tip is grizzly, with a very small mass of reddish hairs on the under side at the extreme tip.

Expanse of fore wings, ♂ 57–60 mm.; ♀ 72 mm.
Length of a fore wing, ♂ 25–30 mm.; ♀ 34 mm.
Breadth of a fore wing, ♂ 14 mm.; ♀ 17 mm.
Length of hind wing, ♂ 22 mm.; ♀ 25 mm.
Breadth of hind wing, ♂ 16 mm.; ♀ 18 mm.

Var. *nevadensis* [*artemis* (Pack.)]. One ♂, three ♀. In the southwestern form the white band is very wide, as wide as in the most extreme eastern examples (one from Colorado is as white as in typical *nevadensis*). The black portion of the wings is more faded, paler, and more hyaline. The ocellus is paler, and that of the hind wings shows a tendency to become obsolete, becoming narrow or irregular, roundish, and without the white line; the tip of the ♀ abdomen is without red hairs.

As regards the moths themselves I can really find no difference between *artemis* and *nevadensis*, though I have had no opportunity to carefully study examples from Arizona or Nevada.

The New Mexican examples are a little larger than any eastern *maia*.

Expanse of fore wings, 86 mm.
Length of fore wing, 36 mm.
Breadth of fore wing, 18 mm.
Length of hind wing, 26 mm.
Breadth of hind wing, 18 mm.

[In Dyar's list *californica* Wright and *artemis* Packard appear as synonyms of *H. nevadensis* Stretch, which is given as a valid species.]

Geographical distribution.—Nevada [Chino, Cal. (*nevadensis*); Dep. Agric. MSS.] Las Cruces, N. Mex. (Cockerell, Townsend); also in the Mesilla Valley, N. Mex., "Middle Sonoran Zone" (Cockerell). [These New Mexico records refer to the form *H. artemis* Packard.]

[Prof. M. H. Swenk (litt. July, 1912) states that *H. nevadensis* is rather abundant in Sioux County, Nebr., where it has been collected and bred.]

[The original account of *H. artemis*, in Proc. Amer. Phil. Soc., XXXI, pp. 172–173, is as follows:]

Hemileuca artemis sp. nov. One ♀ with wings not fully expanded. At first doubtfully referred to *H. juno*, I find on comparison with my types in the Museum of Comparative Zoology at Cambridge that it is quite different. The head and body are larger. The thorax is much more white, both on the prothorax and on the patagia, which are entirely white. The disk of the mesothorax is brown; the two tufts, one on each side behind, are orange-red, instead of claret-red, as in *juno*, and the hairs between the forelegs and those on the fore femora are of the same deep orange-red as the thoracic tufts. *Juno* has more reddish hairs on the end of the abdomen, where they are all white in *artemis*. The fore wings are white, with a black-brown border all around, completely inclosing the entirely opaque black-brown discal spot, which, in the unexpanded specimen, does not inclose (as it does in *juno*) a lunate white spot. The blackish costal edge is as wide as the outer edge. The hind wings are apparently much as in *juno* and in *grotei*. It does not agree with the description of *grotei* (Trans. Amer. Ent. Soc., II, 192, Pl. II, fig. 60, 1868).

Several full-grown larvæ werereceived from Las Cruces, N. Mex., kindly sent me June 15, 1891, by Mr. C. H. Tyler Townsend; they were found feeding on a species of long-leaved willow, and on a Populus. Mr. Townsend writes regarding these caterpillars:

"I am informed that in previous years this caterpillar has been extremely abundant here, almost denuding the cottonwoods (*P. fremontii*). They are said to appear in force later in the season. I rather doubt this, but will look out for more."

Mature larva.—Length 45 mm. The body is long and thick, of the general shape and thickness of *Automeris io*, rather than of *H. maia*. Head dull shining red, about half as wide as the body in the middle. Segments of the body each with an irregular, deeply impressed, transverse wrinkle, just behind the middle. A moderately large prothoracic plate, which is irregular in shape and divided in the middle into two pieces; it is dull reddish honey yellow or chitinous in color. On the prothoracic segment are eight large, high-branched spines, as large as any of the others on the body behind; they are black, with the spinules black at base, pale flesh color beyond; the terminal bristles are dark; there are about 16 to 18 spinules on each spine, nearly as in *H. maia*, and the prothoracic spines of *A. io*. The spines on the second thoracic segment are similar in shape and length to those in front, but slightly shorter and with a smaller number of spinules toward the end. On the third thoracic, to and including the seventh abdominal segment, the two rows of dorsal spines are like those of *A. io* behind the prothoracic segment, being short, thick, bushy spines, with numerous radiating, yellow spinules, which are black at tip. On the eighth segment there is a single, slightly larger one, with two central spines, one on each side. Those on the ninth segment are like the prothoracic ones, the median one being of the same size as the lateral ones. There are no spines on the tenth or last segment. There is a subdorsal and an infraspiracular row of spines like those on the first thoracic segment along the sides of the abdomen, but on the thoracic segments are two rows of infraspiracular spines. There is a rather large, broad, V-shaped or short subcordate plate on the tenth segment of the same color as the prothoracic plate, and a bristly, concolorous plate on the outside of the anal legs.

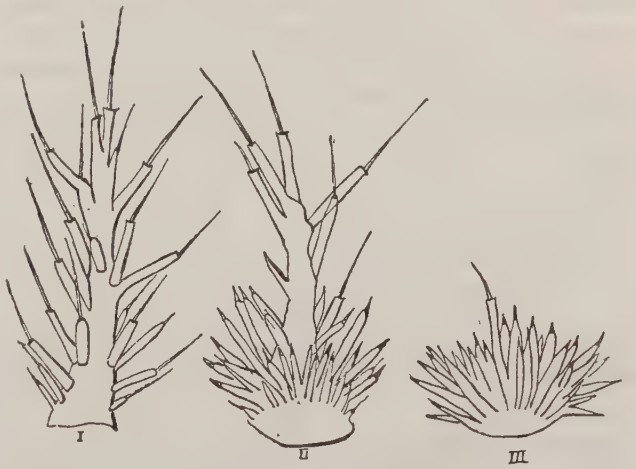


FIG. 9.—Dorsal spines of three thoracic segments of larva of *Hemileuca artemis*.

The body is smooth, without the granulations of *H. maia* and without the lateral reddish band of *A. io*. The body is pale, sea-greenish, with irregular brown spots and slashes in the spaces between the spines of the subdorsal rows, and they also occur lower down near the spiracles, which are yellow, edged with dark brown. Thoracic legs dark honey-yellow; abdominal ones washed with cherry reddish.

The eversible glands were not everted in any of the six specimens, but their position is indicated, as in *H. maia*, by an irregular oval, liver-colored patch behind the first thoracic and eighth abdominal spiracles.

Figure 9 represents the dorsal spines of the three thoracic segments, respectively. I, one of the dorsal prothoracic spines, in which the spinules, with long setæ, are scattered along the whole length of the main trunk; II, one of the dorsal spines of the second thoracic segment, surrounded at the base by a dense thicket of acute spinules, the latter not bearing a terminal seta; III, a dorsal spine from the third thoracic segment, forming a short, broad tuft or clump of nonsetiferous, but acute spinules, the clump having a broad base, from near the center of which arises a long spinule,

bearing a slender seta, like those near and at the ends of those in front. The two dorsal rows of abdominal spines extend back to and including the seventh uromere.

[Manuscript notes by Messrs. Pergande and Pratt show that moths of *H. artemis* (bred from larvæ received from New Mexico) emerged in Washington from October 25 to November 9, the last from a larva received as early as June 6. Eggs hatched April 30. A species of Tachinidæ was bred from a pupa, and specimens of *Apanteles*, bred from this species, were sent from Las Cruces, N. Mex., by T. D. A. Cockerell.]

[The following description is given in the MS. under *H. maia*, but it presumably belongs to *artemis*:]

Larva.—Stage I: The following is a description of larvæ hatched from eggs sent me from Las Cruces and laid on the willow (*Salix longifolia*). They hatched May 4–16. On May 11 one was seen emerging from the shell; it comes out tail first.

The underside of the body, the legs and tubercles, were of a deep flesh color; the body reddish brown, the sutures between the segments deep carneous. The clypeus anterior is paler than the rest of the head. The body tapers somewhat to the end, which is somewhat conical. The head is considerably wider than the body, dull black, with white hairs. The colors after an exposure of a day or two, before eating: Body black-brown, the tubercles on the three thoracic segments much paler, black brown, being of a deep flesh brown, but those on the ninth abdominal segment are nearly as dark as those on the thoracic ones. Under side of the body deep carneous, concolorous with the abdominal legs. The thoracic legs are all somewhat darker than the abdominal ones, especially on the outside.

[The following account by Prof. C. H. T. Townsend, indicating the possible occurrence of two species of the *H. maia* group in southern New Mexico, appeared in West American Scientist, VIII (1893), pp. 51–53. *Hemileuca artemis* Packard. A note was published on this species in Can. Ent., 1892, pp. 199–200, under name of *H. juno* (?). A pupa obtained from larvæ on *Populus fremontii* [1] in June, 1891, and sent to Dr. Packard, had disclosed the moth, which Dr. Packard wrote was probably *H. juno*. Under date of April 29, 1893, Dr. Packard again wrote that this was apparently a new species, which he would name as above. What appeared to be the same larvæ were found at that time, June, 1891, on *Salix longifolia* also. On November 13, 1892, I found in the Alameda, north of Las Cruces, an egg mass of *Hemileuca* encircling a twig of the above *Salix*. The next day I found two more of the egg masses on the *Salix* in the same locality, and, what was more, I saw on, or flying about the *Salix*, several moths of *Hemileuca*, one of which I captured. This was sent to Dr. Packard, who wrote that it was "with little doubt *H. maia*." I had expected it would prove to be *H. artemis*, and I was therefore somewhat disappointed. Several more moths, apparently the same but not captured, were seen during the latter part of November flying about cottonwoods south of Mesilla Park.

It had occurred to me that possibly the larvæ which feed here on *Salix* are *H. maia*, while those on *Populus* are *H. artemis*. This conclusion is shaken by the fact that I have taken the larvæ of *H. maia* on mesquite, and they are much darker (reddish, brownish, or grayish) than those taken on *Populus* and *Salix* in June, 1891, and lack the yellowish or greenish shades of the latter. From the general darker color of the *maia* larva, I believe I can distinguish the two species as they occur here. According to this separation, I find that *H. artemis* feeds here on *Populus* and *Salix*, while *H. maia* feeds on *Populus*, *Salix*, and mesquite (*Prosopis juliflora*).[2] The following notes apply to the lighter greenish and yellowish larvæ, which are those of *H. artemis:*

June 15, 1891: A good number on *Salix longifolia* in the Alameda. Fully grown or nearly so. Migrating.

June 24, 1891: Several specimens on *Populus fremontii* in Alameda. Nearly and quite fully grown.

June 30, 1891: Three more on *Populus* in Alameda. Nearly grown. None on *Salix* where they were found June 15.

May 22, 1892: A number found on a large tree of *Salix* (not S. *longifolia*), about 3 miles south of Mesilla. Yellowish in color, and about half grown.

May 31, 1892. Numerous on *Populus fremontii* just north of Las Cruces. Nearly two-thirds grown.

June 13 to 15, 1892: Many larvæ, from two-thirds to nearly fully grown, were found on *Populus fremontii* in the Rio Grande bottoms between Las Cruces and Rincon, and on up the Rio Grande valley to Los Palomas, N. Mex.

June 29, 1892: A good number found north of Winslow, Ariz., on short *Salix* sprouts in the bottoms of the Little Colorado River. They were about fully grown, and the leaves of the *Salix* were entirely gone.

[1] [This was really *Populus wislizenii* (Watson) Sargent.]

[2] [This was *Prosopis glandulosa* Torrey.]

Hemileuca maia Drury. As will be seen from the above notes, it seems that the female of this species oviposits here on *Salix*, or other food plants, in November; the eggs hatch the following spring. Below are notes on the darker larvæ, supposed to be *maia*.

April 22, 1891: A twig of *Populus fremontii* was found on college farm, bearing eggshells of *Hemileuca* from which the young caterpillars, 2½ to 3 mm. long, had just hatched and begun eating the green leaves. As these were so young, the color could hardly be depended upon. Mr. H. G. Dyar identified them as *Hemileuca* or an allied form.

May 16, 1891: Three miles south of Mesilla, near the Rio Grande River, a mass of dark *Hemileuca* larvæ was noticed on a twig of *Populus fremontii*, and another similar mass on a twig of *Salix* sp. near by. The larvæ held on to the twigs by means of slight but quite strong silken webs, and measured 17 to 20 mm. in length.

May 13, 1892: Some larvæ, which agree well in general color and appearance with the above, were found on mesquite (*P. juliflora*) near the college. They were 1½ to 2 inches long. One larva pupated on top of the earth in a breeding cage, May 27. This, with an alcoholic larva, was sent to Dr. Packard, who wrote that they were *H. maia*.

July 25, 1892: East of Navajo Springs, Ariz., I found a number of specimens of a large brownish and blackish larva, which may be *H. maia*, feeding on *Artemisia filifolia*, a greenish-gray sage. They could not be found on the sage after passing a certain very restricted area, though they were numerous where they did occur. It may have been another species.

NOTE.—I have repeatedly handled the *maia* and *artemis* larvæ in all stages without being stung in the least by the hairs.]

HEMILEUCA GROTEI Grote and Robinson.

Plate LXIII, figs. 1, 2.

[*Hemileuca grotei* GROTE and ROBINSON, Trans. Amer. Ent. Soc., II (1868), p. 192, Pl. 2.]
[*Hemileuca diana* PACKARD, Hayden's Survey, 1873, p. 557, fig. 13.]

[Antennæ black; palpi and front black; behind the antennæ a broad band of white hairs, extending vertically along sides of pectus for a short distance; thorax black, intermingled with sparse white hairs and with a lateral tuft of deep carmine hairs on metathorax; abdomen black with a few white hairs dorsally, and the segmental divisions marked by white hairs ventrally, anal tuft consisting of orange-red hairs; pectus and legs black; base of legs fringed with deep carmine hair. Primaries deep brown-black crossed beyond the cell by a broad irregular band of white, very variable in width and outline; broad at the costa, it is much contracted opposite the cell and is even at times entirely divided into an upper and lower portion; the lower portion may be of even width throughout, or may gradually taper toward the inner margin; the outer margin of the band may be almost straight, but is usually sinuate, curving gently inward below the cell; it is often distinctly crenulate; at the end of the cell is a whitish lunate mark, broadly surrounded by deep black scaling which encroaches more or less into the white band, as mentioned above. Secondaries slightly deeper in color than the primaries, similar in maculation, discocellular lunule smaller and less distinct, white band angled opposite cell, as variable as on primaries. Beneath as above, white postmedian band rather broader as a rule but very variable. Expanse, ♂ 38–48 mm.; ♀ 45 to 54 mm. Described from 4 ♂ ♂ and 10 ♀ ♀ in collection Barnes, from Kerrville, Tex., (4 ♀ ♀) and Chiricahua Mountains, Ariz. All very constant.—J. McDUNNOUGH.]

[Colorado; Texas—Dyar.] North slope of Grand Mesa, Mesa County, Colo., September 20, 1887. Cockerell, Entomologist, 1888, p. 283 (as *diana*).

[Subgenus ARGYRAUGES Grote.]

[*Argyrauges* GROTE, Canad, Entom., XIV (1882), p. 215.][1]

HEMILEUCA NEUMOEGENI (Henry Edwards).

Plate XXIV, fig. 3; LXIII, fig. 5; LXVII, figs. 1, 2.

[*Euleucophaeus neumoegeni* HENRY EDWARDS, Papilio, 1 (1881), p. 171.]

[♂. Antennæ orange; palpi and front deep purplish red; thorax white, mixed with purplish hairs posteriorly; abdomen dorsally with long red hairs, ventrally yellowish white; pectus and base of legs purple-red; tarsi black; tibiæ fringed with whitish hairs; primaries silvery white crossed by two black bands; of these the antemedian is bent outward below costa, thence

[1] [A female from Los Angeles County, Cal. (Coquillett), in the U. S. National Museum, shows an apparently good subgeneric character not mentioned by Grote; the antennæ are long pectinate on *both* sides. In *H. tricolor* they are only serrate on one side on basal half or more.]

almost straight to inner margin; the postmedian is oblique, extending from costa shortly before apex to inner margin near anal angle, somewhat crenulate in its central portion; in the cell and partially situated on the antemedian black band is an oblong semitransparent yellowish dash, broadly margined with black; at the end of the cell is a similar larger lunate mark outlined in black, the outer margin most heavily; secondaries rather smoky white with postmedian black band of primaries continued across their upper surface, parallel to outer margin and slightly crenulate; a black discocellular spot with yellowish center. Beneath as above, except that the antemedian band of primaries and the oblong dash in the cell are wanting. Expanse 43 mm. Described from a single ♂ specimen in collection Barnes, from Yavapai County, Ariz.—J. McDUNNOUGH.]

[♀. Similar to the male, but a little larger, and with the four posterior segments of the abdomen clear white, above and below, the middle segments only being narrowly edged with reddish brown. The stigmata are very strongly marked, jet black. Type locality, Prescott, Ariz. (Doll).—H. EDWARDS, l. c.]

[Dr. Packard examined specimens from Prescott.]

HEMILEUCA BURNSI J. H. Watson.

Plate XXIV, figs. 1, 2; LX, figs. 7, 8; LXIII, figs. 6, 7; CXIII, fig. 3.

[*Hemileuca burnsi* WATSON, Ann. Rept. and Trans. Manchester Entom. Soc., 1910, p. 31, Pl. III.]

[Very close to *H. neumoegeni*, of which it might be considered a race. It is, however, distinct enough for recognition. Mr. J. McDunnough has kindly compared the two species in detail, as follows:

In collection Barnes is a single male *neumoegeni* from Yavapai County, Ariz. (August 16–23), and one ♂ ♀ *burnsi* from typical lot from Watson (Truckee Pass, Cal., 7,000 feet, and a pair from Goldfield, Esmeralda County, Nev., September 2.

The main points of distinction between the males are as follows:

Antennæ of *neumoegeni* bright red-brown as in *tricolor*.

Antennæ of *burnsi* dark brown, much deeper than in *neumoegeni*.

Abdomen of *neumoegeni* is covered with orange-red hair dorsally, much as in *tricolor*) beneath white.

Abdomen of *burnsi* (our specimens are somewhat rubbed) shows no trace of red hairs; the hairs are whitish and not nearly so long as in *neumoegeni*; there is further a lateral row of black spots.

The ground color of *neumoegeni* on primaries is a silvery white; besides the discal lunate mark there is a further elongate mark in the cell, filled with pale yellow and partially obscured by the antemedial black band which crosses it. None of our *burnsi* show any traces of this mark, and the ground color lacks the silvery whiteness of *neumoegeni*.

Our specimen of *neumoegeni* has a very distinct black postmedial band; one of our ♂ specimens [of *burnsi*] is without, the other ♂ and the two ♀ ♀ possess this band.—J. McDUNNOUGH.]

[Mr. Watson has described some variations, as follows:

Ab. *ilmae* Watson t. c., p. 32, Pl. III, fig. 2, ♂. "Body and wings creamy; wings rounder and more ample. Fore wings above; prediscal bands heavier even than in the female and continued broadly along the costa, then narrower to base of wing. Discal spot more rounded. Below, with a submarginal band of black scales as on the female, and not reflected through as the typical male. Hind wings above and below, with a submarginal band as on the female; the discal spot a mere punctuation. Below, a replica of the upper surface. One specimen." This name is to be applied to males having the band on the hind wings as in the normal female.

Ab. *nigrovenosa* Watson, t. c., p. 33, ♀. "Bands heavy, and the upper surface of the fore wing and the under surfaces of both wings with black scales on the veins, from base as far as the black marginal band. Costa of both wings below black; space between the marginal band and the fringes white." From a female which "never stretched its wings."

Ab. *conjuncta* Watson, Entom. News, XXIII (1912), p. 97, Pl. VII, f. 4, ♀. "Differs from typical *burnsi* in having the hinder ends of the apical and transverse black bands of fore wings joined together by a distinct black line running along the hind margin. The nervures outlined with black from the apical (post median) band toward the discal spot." Reno, Nev.][1]

[Watson briefly describes the egg and pupa. The larvæ are described as burrowing into sandy soil, apparently spinning a slight web, certain pupæ having silk attached to the cremaster.]

[Subgenus EULEUCOPHAEUS Packard.]

[*Euleucophaeus* Packard, Rep. Peabody Academy, IV, (1872), p. 88].

Euleucophaeus is a very definite section of *Hemileuca*, and I am not sure but that it should be regarded as a subgenus, or a genus in process of differentiation from *Hemileuca*. While not generically different as regards venation, it differs in the decidedly shorter and broader wings and paler coloration, and in markings, there being a basal and an extradiscal line not present in normal *Hemileuca*, and faint discal spots. All three features may be owing to the reaction from a dry, elevated climate, but they are very distinctive and common to several species.

[The larva of *H. oliviæ* departs widely from typical *Hemileuca* in being a grass-feeder. Whether this is true of all *Euleucophaeus* is not known.]

[In much of the manuscript on the species of *Euleucophaeus*, Dr. Packard has left the generic name blank, evidently being undecided whether to use *Euleucophaeus* or *Hemileuca*. Following the sense of the above remarks, I have placed all the species in *Hemileuca*.]

HEMILEUCA TRICOLOR (Packard).

Plate LXVIII, figs. 9, 10.

Euleucophaeus tricolor Packard [Rep. Peabody Academy, IV (1872), p. 89].
[*Hemileuca tricolor* Holland, The Moth Book, Pl. XII, fig. 9. Good colored figure of male.]

Imago.—Two ♂. Head dull brick-madder, reddish in front as are the femora and breast; vertex of head and top of thorax dark gray, with gray hairs intermixed, with lighter and reddish scales mixed. Antennæ pale reddish brown. Fore wings slightly narrower and more subfalcate than in *E. oliviæ* and much more so than in *E. norba*, but the outer edge is not very full, not nearly so much so as in *H. maia*, and the apex is a little more rounded.

Fore wings dark stone or granite gray, with a slight olive tinge. The basal line is snow white, broad and bent inwards on the costa, where in *E. norba* and *oliviæ* it is not so bent, it also extends inwards along the inner edge to the base of the wing, inclosing a mouse-gray slash situated on vein VI. Discal spot very distinct, somewhat curved or crescent-shaped, and forming the center of an obscure roundish dark spot. Extradiscal line broad, snow white, very distinct, and situated nearer the outer edge of the wing than usual, and ending on the costa much nearer the apex than in any other of the species mentioned. Fringe snow white and on the apex connects with the expanded end of the extradiscal line. Outer edge of the wing between the extradiscal and the fringe is as dark as in the middle of the wing. Hind wings whitish, madder red at the base; there are no lines, and no discal spot is to be seen in my rather badly preserved specimen. Under side of the fore wings along the costa madder red; otherwise as above, the discal spot and lines faintly reproduced. Hind wings as above. Abdomen madder red, beneath broadly banded with white. Legs reddish with gray hairs at base.

Expanse of fore wings, ♂ 52 mm.; ♀ 68 mm.
Length of fore wing, ♂ 26 mm.; ♀ 33 mm.
Breadth of fore wing, ♂ 12 mm.; ♀ 16 mm.
Length of hind wing, ♂ 19 mm.; ♀ 23 mm.
Breadth of hind wing, ♂ 12 mm.; ♀ 16 mm.

[1] [Mr. Watson has since obtained from a second year pupa of *H. burnsi* a female "with entire wings suffused along margin and costa with lilac-gray scales, more pronounced below," almost the shade of the gray on *H. tricolor*. This he has described in Entomological News, Vol. XXIV, p. 130, as ab. *paradoxa*. He has also obtained a female with the extreme edge of hind wings with a single row of black scales, forming a black line between the margin and the white fringes.]

One ♀. The female is much larger than the ♂; the fore wings are broader, dark gray, with a brownish tint extending from the discal spot to the inner margin; the veins are more or less tawny. The costal and apical region is hoary. The basal line is narrow, being one-third as wide as in ♂, becoming nearly obsolete before reaching the costa, the angle it makes in the ♂ being obscure; it is very indistinctly continued along the base of the wing to the thorax. The extradiscal line is about one-half as wide as in the ♂, and the marginal dark gray shade is much wider than in the ♂. The hind wings differ from those of the ♂ in being dusky white; in having a whitish extradiscal line, the margin broadly shaded with dark gray. A faint discal discoloration. Fringe snow white, becoming dusky on the inner angle. Underside of fore wings gray, with a vinous tinge; fringe dusky whitish; veins vinous reddish. The discal spot and the two lines faintly reproduced. Hind wings beneath dusky white; extradiscal line whitish; margin of wings dusky; fringe whitish.

Of this species *Euleucophaeus lex* Druce is evidently a synonym. [Dr. Dyar thinks this synonymy is impossible.]

For a pair of this fine moth in a perfectly fresh state of preservation I am indebted to [Mr. O. C. Poling, who states that the species is fairly plentiful in the Santa Catalina Mountains, Ariz., where it appears in February, March, and April.]

Geographical distribution.—This well-marked species seems to be confined to the region about Prescott, Ariz.

HEMILEUCA OLIVIÆ (Cockerell).

Plate XXIV, fig. 4; LII, fig. 8; LX, fig. 9.

Hemileuca sororia race *oliviæ* Cockerell, Psyche, p. 252, 1898.

Imago.—Five ♂. A very pale cream-colored species with a decidedly faded out appearance. Fore wings, longer, more produced toward the apex; in shape as in *E. tricolor,* but slightly less subfalcate and much paler, with no dark scales, and not so wide as in *E. norba,* and hue much paler; veins not ochreous. Head in front shaggy, pale ochreous, concolorous with the femora and breast, the scales on the vertex long and shaggy and of the same pale gray as the thorax in front. Thorax either entirely pale olive-gray or with shorter reddish hairs intermixed. Wings of both pairs of the same uniform faded olive-gray hue, almost whitish or cream-colored; costa of fore wings nearly straight; slightly arched toward the apex, which is a little more produced and rounded, than in *E. norba,* but just as in *E. tricolor,* though the wing has not quite so subfalcate an outline as in *E. tricolor,* being slightly wider. Basal line broad, white, diffuse, situated two-thirds of the way from the base of the wing to the discal spot, and not bent on the costa. Extradiscal line white, diffuse, not so near the outer edge of the wing as in *E. tricolor,* more oblique and less undulating and diffuse than in *E. norba.* The discal spot differs from that of *E. norba* and *tricolor* in being shorter, broader, and more curved or kidney-shaped than crescentiform. Fringe of wings of both pairs concolorous with the rest of the wings. Hind wings of exactly the same hue as the fore wings; a very faint linear discal spot; no traces of whitish lines above or beneath. Under side of fore wings; costal region ochreous, and the veins on the outer half of the wing ochreous, but from their base to the discal spot the wing is bathed with roseate, becoming dusky beyond the discal spot, which is much curved and distinct. Extradiscal line very faint, dusky. Hind wings as above, but very faintly roseate at base. Abdomen rather bright brick or madder red, especially on the end, being nearly of the same color as in *E. norba;* thorax and abdomen beneath pearly dusky gray and femora of the same hue, but the tibiæ and tarsi subochreous.

Expanse of fore wings, ♂ 55 mm.
Length of fore wing, ♂ 25 mm.
Breadth of fore wing, ♂ 13 mm.
Hind wings, length, ♂ 20 mm.
Hind wings, breadth, ♂ 15 mm.

This species is near *E. sororia* and *hualapai*.[1]

Among the material used in preparing this description are two specimens kindly given me by Prof. Cockerell.

Geographical distribution.—Las Vegas, N. Mex.; Maxwell City, N. Mex., bred by Cockerell from larva sent by John Davis (Cockerell). Cimarron River, northern New Mexico, October 17, 1875 (W. L. Carpenter). Not yet found in Mexico; quite restricted to New Mexico. [Ainslie, Bull. 85, Part V, Bureau of Entomology, U. S. Dept. Agric., p. 62, records it from southern Colorado, Texas, and Oklahoma. It is also thought to occur at Garden City, Kans.]

[The following appeared in Psyche, 1898, p. 298:]

Hemileuca sororia race *oliviæ* Ckll., Psyche, 1898, p. 252, ♂ (Santa Fé., N. Mex.).

On August 20, 1898, Mr. John Davis sent me some larvæ collected at Maxwell City, N. Mex., stating that they were then extremely numerous, and were devouring the pastures. With the larvæ were sent pieces of grass, which Prof. E. O. Wooton identifies as a *Muhlenbergia*, probably *M. texana* Thurb. (*porteri* Scrib.). Form these larvæ I bred four moths of *oliviæ*, which was only known heretofore by a single ♂. A male emerged September 13, two males September 14, and a female September 15.

Larva.—Of the living larva I noted as follows: Ochreous with a very dark-brown head; body irregularly marked with very dark brown, especially about the sutures; tufts of spines as usual in the genus, the central ones black, the lateral ones (spinules) ochreous with black tips; thoracic legs black. The skin is sparsely beset with colorless hairs. Spiracles narrowly edged with black.

Cocoon.—The cocoon is composed mainly of fragments of the *Muhlenbergia*, loosely woven, with many open spaces.

Imago.—The males agree in the main with the Sante Fé type, but are, perhaps, a little grayer. The female expands 65 mm., and has a warmer, more rosy, color than the males. The general color of the anterior wings is nearly uniform with the two pale bands distinct.

Compared with the description of *H. sororia* Hy. Edw., the ♀ *oliviæ* differs thus: Costa of primaries orange ferruginous throughout; secondaries above with the nervures pale ferruginous; on the under side the nervures are pale ferruginous on all the wings, and the costa of the primaries is broadly orange ferruginous, subfuscous at base, that of the secondaries washed with blackish; head clothed with dark fuscous hair, gray on vertex and occiput; thorax with dense long, gray hair; antennæ entirely bright orange; abdomen above with fuscous hair, chestnut on the first two segments; hind margins of third to fifth segments with red hair, which is replaced by white on the extreme sides, and beneath except in the middle; apex with mixed fuscous, white, and red hair. The expanse is 11 mm. less than that of *sororia*. *H. oliviæ* is of about the same size as *H. sororia hualapai* (Neumoegen) from southwestern Arizona, but differs in the markings. The three forms, *sororia*, *hualapai*, and *oliviæ*, are clearly geographical races of a single well-marked species.

In the Mesilla Valley, N. Mex., I have never taken *H. oliviæ*, but only *H. maia* race *artemis* (Pack.) and *H. juno* Pack, the former being much the most frequent.—T. D. A. Cockerell.

Hemileuca oliviæ is now known from Santa Fé, N. Mex., Maxwell City, N. Mex., Las Vegas, N. Mex., and Raton, N. Mex. The Raton record is based on a ♂ taken there by my wife (Wilmatte P. Cockerell) during September of this year. The Las Vegas record is based on a large number of males taken by my wife and myself flying around an electric light in this city, October, 1900. The moths taken at the light at this time were all *H. oliviæ*, except one *Ennomos magnaria*. *H. oliviæ* is evidently common in northern New Mexico, but as it does not fly until September and October, it has escaped the notice of collectors. I have never seen anything

[1] [Two distinct aberrations are in the National Museum, having been obtained by Mr. F. Springer at Cimarron, Colfax County, New Mexico.

(1) ab. *grisea*. Male. Broad area between the pale bands on primaries dusky gray, much darker than usual. There is a female form with the same tendency to gray, but not so marked.

(2) ab. *suffusa*. Female. Upper side suffused with reddish stone color, the costal region broadly blackish, especially toward the base; bands indistinct. Under side suffused with blackish, with reddish orange costa and streaks. The discal spot on primaries above has a pallid center.]

of it in southern New Mexico (Mesilla Valley), and do not think it exists there.—T. D. A. Cockerell in litt. to Dr. Packard, November 3, 1900.

[Since the above was written, the larva of this species has been found exceedingly destructive to the grass ranges in northern New Mexico. For a full and most interesting account of the species, its transformations, habits, etc., see C. N. Ainslie, "The New Mexico Range Caterpillar," Bureau of Entomology (Dept. Agriculture), Bull. 85, Part V (1910). The technical description of the eggs, different larval stages, pupæ, and moths are by Dr. H. G. Dyar.]

[*Parasites* (cf. Ainslie).—*Pimpla conquisitor* Say, *P. sanguinipes* Cress., *Chalcis ovata* Say, *Tachina mella* Walker, *Euphorocera claripennis* Macq.

Predatory enemies (cf. Ainslie).—*Stenopogon picticornis* Loew (attacking larva); *Erax varipes* Williston (attacking imago).]

[Dr. H. G. Dyar, Proc. Ent. Soc. Wash., 1911, p. 5, has given the following table for the separation of the species allied to *H. oliviæ:*

Veins of the wings lined with ocher yellow:
- Ground-color of fore wing blackish, inner line absent ..... *dukinfieldi* Schaus.
- Ground-color of fore wing pale gray, both lines present.
  - Hind wing without submarginal pale band ..... *rubridorsa* Felder.
  - Hind wing with submarginal pale whitish band.
    - Larger: Disk of thorax roseate; discal mark of fore wing narrow ..... *norba* Druce.
    - Smaller: Disk of thorax gray; discal mark of fore wing large, white ..... *minette* Dyar.

Veins of the wings concolorous:
- Costa of fore wing above ocher yellow.
  - Secondaries pale, whitish in the male, rose-color in the female.
    - Lines of the fore wing faint, the inner one obsolete ..... *hualapai* Neumoegen.
    - Lines of the fore wing distinct, both present.
      - Hind wing of male with no, or very faint, mesial band ..... *mania* Druce.
      - Hind wing of male dusky shaded, with mesial and marginal bands rather distinct ..... *lares* Druce.
  - Secondaries dark rosy brown.
    - Smaller, with much rosy tint ..... *numa* Druce.
    - Larger, with little rosy tint ..... *nitria* Druce.
- Costa of fore wing concolorous or partly whitish.
  - Pale, the male largely whitish, the lines of fore wing diffused ..... *oliviæ* Cockerell.
  - Darkly colored, the lines of the fore wing distinct.
    - Inner line not angled in the middle.
      - Discal mark yellowish brown ..... *sororius* Henry Edwards.
      - Discal mark white or whitish.
        - With much rosy tint; discal mark narrow and clouded ..... *marillia* Dyar.
        - With little rosy tint; discal mark large, distinct ..... *lex* Druce.
    - Inner line distinctly angled or the upper limb obsolete ..... *mexicana* Druce.]

HEMILEUCA DUKINFIELDI Schaus.

[*Hemileuca dukinfieldi* Schaus, Proc. Zool. Soc, Lond., 1894, 235.

Described from Castro, Paraná, Brazil. The types are before me. This species is only distantly related to the forms here treated, and is included as the extreme development of this type.—Dyar, t. c.]

HEMILEUCA RUBRIDORSA Felder.

[*Hemileuca rubridorsa* Felder, Reise der Novara, Pl. 90, fig. 2, 1874.

Felder's description is without definite locality; his figure represents a female. A female specimen from the Schaus collection is before me labeled "Mexico," without definite locality. It is also labeled "*Euleucophæus norba* Druce," but it differs from that in the uniform gray hind wings without submarginal pale band and in the broader yellow costa. It agrees well with Felder's figure. A male also is before me, collected by Mr. R. Müller in Mexico City, which enables a definite location for the species.—Dyar, t. c.]

HEMILEUCA NORBA Druce.

Plate LII, fig. 10.

Imago.—Two ♂. Head rather narrow, the front triangular, narrowing almost to a point in front, rust-red. Palpi not distinguishable from the front. Thorax clothed with rosy and gray hairs, the latter predominating, but red at the base of the second pair of wings.

Fore wings very short and broad, more so than in *oliviæ* or any other species seen by me; outer edge not oblique; wings of both pairs of a uniform peculiar pearly pale mouse-gray hue and semitranslucent, thinner than in *oliviæ*. Veins ocher yellow and very distinct; costa of fore wings also ocher-yellow; the fringe concolorous with the wings. Fore wings crossed by two distinct white lines of equal width and parallel, the inner (basal) running close to or touching the discal spot, which is a very faint pale line, less distinct than in *oliviæ*, and much less so than in *tricolor;* extradiscal line a little nearer the outer edge of the wing than to the discal line; it begins on the inner edge nearer the inner angle of the wing than in *oliviæ*, and does not end on the costa so near the apex as in *tricolor*. Hind wings with a single whitish extradiscal line, nearly obsolete in one ♂; it runs parallel with the outer edge of the wing.

Under side of fore wings roseate on the inner two-thirds, the costa and outer edge being ocherous, the roseate hue extends out between the veins toward the outer edge of the wing. The linear discal mark is repeated beneath. In one ♂ the wings beneath are less roseate and the under side of the hind wings is nearly as above.

Abdomen rust reddish above, beneath carmine red, with pale gray hairs on the side.

It is a very distinct species, and may be recognized by its pearly gray color and the two distinct white parellel lines on the fore wings.

Expanse of fore wings, ♂ 48–53 mm.
Length of fore wing, ♂ 24–26 mm.
Breadth of fore wing, ♂ 14–15 mm.
Length of hind wing, ♂ 20–22 mm.
Breadth of hind wing, ♂ 15–16 mm.

[Described by Druce from a male collected at Amecameca, State of Morelos, Mexico.]

HEMILEUCA MINETTE Dyar.

Plate LXII, fig. 12.

[Front of head ocher, sides and behind crimson, thorax gray, abdomen dark red. Fore wing dark gray, the veins and costa dark ocher, fringe and inner margin pale; lines somewhat approximate, whitish, distinct, approximately parallel to outer margin, the outer wavy crenulate; discal mark a large, white, diffused patch, bare of scales centrally. Hind wing gray, a whitish ray through the cell, a broad, distinct, outer whitish band; fringe pale, veins lined with dark ocher. Beneath the ocher markings are broadened, but the lines of fore wing nearly obsolete. Discal mark and submarginal band of hind wing distinct; base of fore wing shaded with crimson. Expanse 40 mm.

One male, Mexico, without definite locality (Schaus collection), probably from near Mexico City.

Type.—No. 12931, United States National Museum.

This species, together with the *norba* and *rubridorsa*, may prove to be varieties of one species. All apparently come from the high Mexican plateau in the vicinity of Mexico City. A large series of specimens is needed to decide the matter.—Dyar, t. c.]

HEMILEUCA MANIA Druce.

[*Euleucophæus mania* Druce, Biol. Cent.-Am., Lep. Het., II, 420, 1897.

Described from Orizaba, Mexico. I have specimens from this place (Schaus collection) and from Motzorongo (R. Müller), both localities in the State of Vera Cruz, in the hot, moist

country. The females are very rosy in color and must be very similar to *hualapai* Neum., but on the fore wings both the lines are distinct. The males vary considerably in the amount of rosy tint on the wing, most of them being largely brown.—Dyar, t. c.]

HEMILEUCA LARES Druce.

[*Euleucophæus lares* Druce, Biol. Cent.-Am., Lep. Het., II, 420, 1897.

This is known to me only by Druce's figure. It is described from a single male from Durango City. This is on the western edge of the high table-land, in a climate similar to that of Arizona The species should be intermediate between *mania* and *hualapai*, but unfortunately only the male of *lares* is known and only the female of *hualapai*, so that no useful comparisons can be made.—Dyar, t. c.]

HEMILEUCA NUMA Druce.

[*Euleucophæus numa* Druce, Biol. Cent.-Am., Lep. Het., II, 421, 1897.

Described from Mexico City. I have specimens from there (Schaus collection) and also others sent by Mr. Müller from the same locality. The high table-land centering in the vicinity of Mexico City is evidently the stronghold of the species of *Hemileuca* of the grass-feeding group.—Dyar, t. c.]

HEMILEUCA NITRIA Druce.

[*Euleucophæus nitria* Druce, Biol. Cent.-Am., Lep. Het., II, 421, 1897.

Described from "Mexico" without definite locality. I have no specimens of the species. It is apparently closely allied to *numa*, and may be a variety of that. Its relations can not be well discussed without more definite knowledge of the exact locality.—Dyar, t. c.]

HEMILEUCA HUALAPAI (Neumœgen).

Plate LXVII, fig. 5.

[*Euleucophæus hualapai* Neumœgen, Papilio, III (1883), p. 138.]

♀. Antennæ pectinated; pale flesh rose, uniform, with no markings whatever [except], a slight linear discal streak; costa yellowish; fore wing rather broad; southwestern Arizona. [Note doubtless based on examination of type.]

[Known only by a single female from southwestern Arizona. In the absence of fresh material, we have only the original description to go by, which indicates that the species is not the same as *oliviæ*. The costa is stated to be bright yellow, which is not the case in the female *oliviæ*, although there is considerable ocherous shading in some specimens. The whole insect is described as being very pale and rose colored.—H. G. Dyar, in Ainslie, 1910.]

[Mr. J. Doll informs me that the type specimen of *hualapai* was collected by Morrison. The fore wings are less pointed than in *H. sororia*, and the stigmatic spot is as in *oliviæ*, not as in *sororia*. On the other hand, *sororia* and *oliviæ* have rather similar markings, while *hualapai* looks quite different.]

[We have a single ♂ specimen received from Geo. Franck, of the Am. Ent. Co., purporting to come from Chiricahua Mountains, Arizona, but it seems probable that it is really *mania* Druce from Mexico, as the banding is strong on primaries.—J. McDunnough.]

HEMILEUCA MARILLIA Dyar.

Plate LXI, figs. 7, 8.

[Rosy brown to dull rose color. Thorax rosy brown with whitish overcast. Fore wing with the costa more or less marked with whitish, but no ocherous; lines broad, distinct, whitish; discal mark narrow, whitish, obscure. Hind wing rosy brownish in both sexes, with an outer whitish diffused line. Beneath the lines faintly reproduced, the basal part of the fore wing red. Abdomen dark rose-red. Expanse: Male 50 mm.; female 60 mm.

Two males, two females, Tehuacan, State of Puebla, Mexico (R. Müller, No. 1753).

Type.—No. 12932, United States National Museum.

This is closely allied to the following species, and may prove to be not specifically distinct therefrom. The present species comes from the southern end of the Mexican plateau, whereas *lex* has been found some 600 miles farther north. Specimens from intermediate points are needed to show the relationship of these forms.—Dyar, Proc. Ent. Soc., Wash., 1911.]

HEMILEUCA LEX Druce.

[*Euleucophæus lex* Druce, Biol. Cent.-Am., Lep. Het., II, 420, 1897.

Described from a single male from Durango City at the foot of the Sierra Madre. The species is not before me, but it is interesting to note the similarity in location with that of the allied *oliviæ*. Both species inhabit high, arid land on the eastern slope of a mountain range.—Dyar, t. c.]

HEMILEUCA SORORIA (H. Edwards).

Plate LXIII, fig. 14.

[*Euleucophæus sororius* H. Edwards, Papilio, I (1881), p. 100.]

[The original description, based on a single female from La Paz, Lower California (Mexico), is as follows:

Primaries pale reddish brown, a little paler at the posterior margin. The lines are broad white, the inner one oblique, not curved, and not reaching to the costa, the outer one slightly waved about the center toward the posterior margin. In the median space, a little nearer to the inner than the outer line, is an oblong discal mark of yellowish brown. The costa at the base is brownish, in the median space it is flecked with white scales, and at the apex it is white from the junction of the exterior line. Fringe and internal margin whitish, with a pink tinge.

Secondaries dull reddish brown, paler on the disk; the nervures very strong and distinct; the fringes clear white.

Beneath the wings are pale reddish brown, the bands of the primaries faintly exhibited.

The fringes and the costal margin of secondaries clear white. Head red brown, orange at the base of the antennæ. Thorax red brown, with long grizzled hairs. Abdomen chestnut brown, with broken whitish lateral bands. Antennæ beneath and tarsi bright orange. Exp. wings, 3 inch.]

[Compared with *H. oliviæ* ♀, the primaries are more pointed at apex, inclined to be subfalcate; the discal mark is not so nearly at right angles to costa, but if prolonged to costa would make an acute angle on inner side; the outer pale band has a double curve.]

HEMILEUCA MEXICANA Druce.

[*Metanastria mexicana* Druce, Biol. Cent.-Am., Lep. Het., I, 201, 1887.
Dendrolimus mexicana Kirby, Cat. Lep. Het., I, 816, 1892.

This species was described as a lasiocampid, but, although no specimens are before me, it is evident from Druce's apparently excellent figures that it is a member of this genus. The species was described from two specimens in the collection of the late Dr. Staudinger, and are without exact locality. It seems doubtful whether the two sexes are correctly associated. The ♂ is represented with a dark discal mark, the ♀ with a pale one, and there are other differences that would not be expected in sexes of one species.—Dyar, Proc. Ent. Soc. Wash., 1911, p. 10.]

HEMILEUCA [PACKARDI n. sp.].

Plate LII, fig. 9.

Imago.—Antennæ with the joints shorter than thick; the outer pectinations about four times as long as the inner, which are tooth-like on the basal half, but beyond the middle nearly as long as the outer ones.

Thorax and wings of a beautiful delicate rose-carmine; the wings thin. Head dull ochreous in front. Thorax lake color, with pale gray hairs longer than the others. Fore wings uniform pale delicate lake, becoming at the base of the wings a little deeper in tone; they are crossed

by two slightly undulating broad white parallel lines, the outer extradiscal nearer the basal line than the outer edge of the wing and ends on the costa farther from the apex. Discal spot linear, faint. Extreme edge of wing paler than within. Hind wings with no lines or other markings, uniformly soft delicate lake, of the same hue as the middle of the fore wing.

Under side as above, a little deeper in hue; no discal spot or lines present; costal edge ocher. Legs of the same color as the front of the head. Abdomen more red above than beneath, and with lake-colored hairs along the middle; beneath being lake, with gray patches on the sides of the abdomen.

Expanse of the fore wings, ♀ 63 mm
Length of a fore wing, ♀ 30 mm.
Breadth of a fore wing, ♀ 15 mm.
Length of hind wing, ♀ 23 mm.
Breadth of hind wing, ♀ 15 mm.

This is very different from the other species known to me, and is one of the most beautiful of moths. I do not think it can be the ♀ of *E. norba*. [Related to *H. marillia* Dyar, but with lighter, brighter colors.]

Geographical distribution.—Tacubaya, Mexico (O. T. Barrett).

PSEUDOHAZIS Grote and Robinson.

[*Pseudohazis* Grote and Robinson, Ann. Lyc. New York, VIII (1866), p. 377.]

[SYNOPSIS OF SPECIES AND VARIETIES.

Discal mark of hind wing elongate, more or less comma-shaped; wings white or pale yellow.....*hera* (Harris).
Hind wing with marginal dashes.....*hera hera* (Harris).
Hind wing without marginal dashes.....*hera marcata* Neum.
Discal mark of hind wing rounded or subquadrate, not elongate.
Fore wings washed with purple, hind wings dark ocher.....*shastaënsis* Behrens.
Fore wings with moderate markings.....*shastaënsis normalis* Dyar.
Fore wings heavily suffused with black, the pale colors nearly obliterated....*shastaënsis shastaënsis* Behrens.
Fore wings with the black marks obliterated, or faintly indicated in grayish....*shastaënsis denudata* (Neum.).
Fore wings pale yellow (or margin more or less dark ocher); hind wings dark ocher.....*eglanterina* (Bdv.).
Both wings pale ocherous yellow, with the usual markings.....*eglanterina uniformis* Cockerell.

H. G. Dyar and T. D. A. Cockerell.]

[Great differences of opinion have been prevalent concerning the forms and species of *Pseudohazis*. In the quotation from Neumoegen given below *shastaënsis* with the purple coloring is treated as *eglanterina*, while Dr. McDunnough considers *shastaënsis* and *eglanterina* to be one species, and so treats them in the description he has kindly furnished. Dr. Dyar had regarded *nuttalli* Strecker as a variety of *eglanterina*, but on rereading the description concludes that it is a simple synonym. He also finds *pica* Walker to be a simple synonym of *hera*. In The Moth Book, Dr. Holland has figured *P. eglanterina* as *pica* and *P. shastaënsis normalis* as *nuttalli*. His figure of *hera* (Pl. IX) is correct.]

[The genus *Pseudohazis* has only two typical representations so far known, one being *eglanterina*, with the purple coloring, and the other the white *hera*, from Utah's salt regions. *Hera* has to be considered a distinct species, for, aside from its white color, its primaries are falcated, while those of *eglanterina* are broad and blunt. All the rest are variations of *eglanterina*, *pica* Walker being especially recognized by its heavy black markings and black basal areas.—B. Neumoegen, Canad. Entom., XXIII (1891), p. 145.]

[Boisduval says of *eglanterina*, "alæ anticæ albido-carneæ," which applies to the form described as *arizonensis* by Strecker. Behrens's *shastaënsis* was described from very black examples of the purple-winged form, so this name will obtain. The form is constant, and has as good right to specific recognition as any species in the genus.—H. G. Dyar, Psyche, May, 1894, p. 91.]

[*Habits.*—The moths appear to be diurnal in their habits, and may be found in vast numbers in the morning hours on bright days in their favorite haunts in the region of the Rocky

Mountains. I have found them particularly abundant about Laramie Park in Wyoming in the latter part of June and July. They appear to frequent flowers in company with diurnal lepidoptera, as the various species of *Argynnis*, and they may then be easily taken. Their flight is rapid. They are characteristic of the country of the sagebush and the ranges of the western sheep herder.—W. J. Holland, The Moth Book, p. 93.]

PSEUDOHAZIS EGLANTERINA (Boisduval).

Plate XXIV, figs. 5, 6; XXV, figs. 1, 2; LXII, figs. 1, 2; LXVIII, figs. 3, 4.

[*Saturnia eglanterina* Boisduval, Ann. Soc. Ent. France, (2) X (1852), p. 323.]
Telea eglanteriæ Herrich-Schaeffer, Sammlung Aussereur. Schmett. (1855), p. 60.

[♂. Antennæ, deep-brown; head and thorax clothed with rough yellow hair, at times heavily intermingled with black; patagia often distinctly pinkish; abdomen dorsally yellow, ringed with black, anal tuft yellow, ventrally pale ochreous, usually shaded with pink and heavily ringed with black; pectus and legs bright yellow. Primaries variable in ground color, at times uniformly pale ochreous, usually largely suffused with pink; costal and outer margin narrowly black; a broad irregular antemedian black band, straight below costa to subcostal vein, then strongly bent outward to inception of vein 2 and again curving inward to inner margin two-fifths from base of wing; this band is connected with the base of the wing by a still broader black band in the submedian fold; a broad postmedian black band bent outward below costa, then parallel to outer margin; the terminal area of wing is crossed by black rays extending along the veins from outer margin to postmedian line and bending to coalesce opposite the cell; apex of wing rather broadly black; in the median area at end of cell a large irregularly circular patch with a central white semitransparent lunate [spot], at times obsolete; beyond this patch in the interspace between veins 4 and 5 the ground color is usually a bright yellow; veins in the median area, especially anal vein slightly marked with black scaling. Secondaries bright yellow, with postmedian band of primaries repeated, and rather sharply angled opposite the cell; the base of wing is usually broadly blackish, but at times the black suffusion is wanting and an antemedial black band alone is present, the black rays of the terminal area do not attain the postmedian band, but form triangular patches along the outer margin, more or less coalescent at their bases; black discocellular patch as on primaries with faint central white dash, more or less obsolescent.

Fig. 10.—*Pseudohazis eglanterina* from California; larva, stage I.

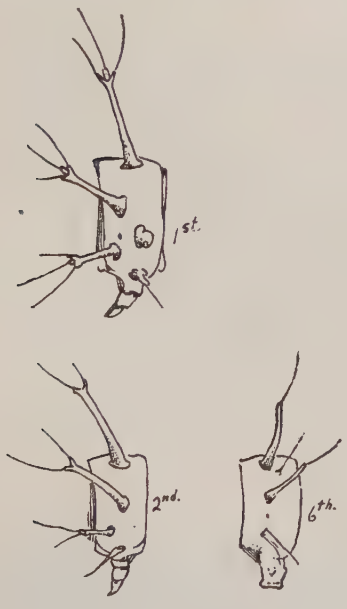


Fig. 11.—*Pseudohazis eglanterina* from California; larval segments; May 19.

Beneath, primaries bright yellow, paler along costa and at apex; markings as above but more sharply defined, less diffuse; terminal black dashes not attaining postmedian band.

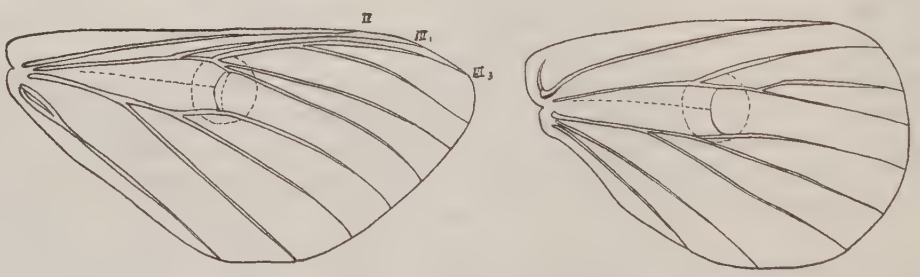
Secondaries pale ochreous or pink, shaded with bright yellow along inner margin and lower portion of outer margin; a large black patch on costa near base of wing, from the lower outer margin of which a narrow curved black line extends to near inner margin, occasionally the whole basal area may be suffused with black as on upper side; other maculation as above. Expanse 37–43 mm.; ♀ similar in maculation to the ♂, but with the markings more sharply defined; generally brighter in color, the primaries being either bright yellow suffused along costa and at base with deep pink, or else entirely pink. Beneath the ground color of both wings is deep orange-yellow slightly suffused with pink. Expanse 40–43 mm. Transition forms leading over to ab. *denudata* Neum., in which all the maculation is obsolete, and to form alt. *shastaënsis* Behrens, a melanic form from high altitudes, are not rare in the male sex. Described from 10 ♂ ♂, 3 ♀ ♀, in collection Barnes, from Deer Park Springs, Lake Tahoe, Cal. (Barnes) (July 1–15); Victoria, B. C. (one ♂); Verdi, Nev.; south Utah (Barnes).—J. McDunnough.]

Fig. 12.—*Pseudohazis eglanterina* from California; caudal end of larva; June 16, 1893.

[Variety *uniformis* Cockerell is based on a male collected by Mr. S. A. Rohwer south of Island Lake, Colo., September 2, 1905, at an altitude of 11,000 feet. The ground color of the wings, above and below, is a rather light ochreous yellow, the secondaries above a little brighter and clearer than the primaries, but the difference is hardly noticeable. There is no yellow shade beyond the discal spot on primaries. The form and markings are as in *eglanterina*, not as in *hera*.]

[The United States Department of Agriculture has received *P. eglanterina* from Santa Rosa and Santa Clara Counties, Cal.]

Larva.—Stage I: [From Manitou, Colo., received from Prof. C. V. Riley; Pergande's notes, July 22, 1877, state that larvæ were found by Prof. Riley at Manitou, feeding on willow; a half grown larva was blown, and marked 889P.] Length 5 mm. The spiniferous tubercles are arranged, as in *Automeris io*, in eight rows, those of the two rows, one on each side of the median line of the body, and the subdorsal ones being the larger and longer, while those on the side of the body become shorter and smaller as they approach the under side of the body. The spine-bearing warts are larger and swollen compared with those of *A. io*. The dorsal spines on the prothoracic segment differ from those of *A. io* in having the trunk spinulated, the spinules being



13 13a

Figs. 13, 13a.—Venation of *Pseudohazis eglanterina;* male; normal, black and reddish fore wings, and yellow hind wings.

long and each bearing a long, tapering hair; the main spine is pale but ends in two long black forks, each tine of which is two-thirds as long as the trunk of the spine itself, while the bristle arising from each fork is as long as the later. The spines of the two lower rows are spinulate on the trunk but are pale throughout, while the larger ones on the back are dark at the end, being pale at the base. The dorsal spines on the abdominal segments differ from those of the thoracic segments in having a somewhat verticillate arrangement of the large five or six terminal spinules, all being pale except the terminal one, which is considerably larger than the others.

The single median spines on the eighth and ninth abdominal segments, respectively, occupy the same position as in *A. io*, but are larger in proportion and are *not forked* as they are in *A. io;*

on the contrary they resemble spines, one being larger and darker than the others; the spine on the ninth segment is a little smaller than the one preceding it.

To recapitulate, it will be seen that the spinulate spines of *Pseudohazis eglanterina* in stage I are more complicated than those of *Automeris io* of the same stage, so that the body is more concealed from view. The thoracic dorsal spines are forked but not so simply as in *A. io*, while the median single ones on the eighth and ninth abdominal segments are not forked but more or less densely spined in irregular whorls, with one of the spines larger than the others.

FIG. 14.—Head of *Pseudohazis eglanterina;* from dried specimen.

Fully grown larva.—The following description was drawn up many years ago from between 40 and 50 alcoholic specimens from the Gulf of Georgia, Cal., in the Museum of Comparative Zoology. There was no noticeable variation in the lot. The larva is intermediate in its characters and in size between *Hemileuca maia*, which it more nearly approaches, and *Automeris io*. The head is smaller than in either of the two genera mentioned; in the thickness of the body it approaches *A. io* rather than *H. maia*. The shape of the clypeus is much like that of *H. maia*. The dorsal spines are whorled as in *H. maia*. The lateral subdivided or whorled setiferous spines are longer than those of the two dorsal rows, but are not so long as in *H. maia*. The arrangement of the longer spines on the thoracic segments, and on the eighth and ninth abdominal segments are as in *H. maia*, but they are shorter, more bushy and more subdivided. The suranal plate is triangular lunate. The dorsal spines are shorter and sharper than those of *H. maia*, being very sharp and the prick painful even in alcoholic specimens.

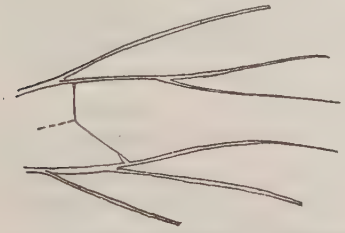


FIG. 15.—Detail of hind wing of *Pseudohazis hera*. Ranch, Utah (Siler).

The head, body and spines are black; in *H. maia* the head is reddish, in *A. io* amber. There is no special coloration to mark the larva of *H. eglanterina*, the body in alcoholic specimens being uniformly dark.

Larva of fourth stage.—The larva in this stage scarcely differs from that in the last stage, the inequality between the length of the dorsal and upper lateral spines is observed in this stage.

Mr. H. Edwards has described (Proc. Cal. Acad. Sci., 19 April, 1875) the eggs and the mature larva; he states that it feeds on *Frangula californica* [*Rhamnus purshiana* de Candolle] and *Rosa*. He states that the head is black, and the body entirely dull black. "Each segment is armed with six lateral spines, very finely branched, and two dorsal fascicles of spines, bright chestnut color, blackish in the center. The branchlets of the spines are all bright chestnut in color. Underside, as well as the feet and abdominal legs, dull black. Length, 2 inches."

[The above account appeared in Psyche, March–April, 1890, pp. 325–327.]

[J. E. Cottle, of San Francisco, gives rose as a food plant of *P. eglanterina*.]

[*Parasites.*—*Apanteles* sp. was bred from larvæ of *P. eglanterina*, and sent in by L. E. Ricksecker, Santa Rosa, Cal., according to Pergande's notes.]

PSEUDOHAZIS SHASTAËNSIS (Behrens).

Plate XXV, fig. 3; LXII, figs. 3–7; LXVIII, fig. 5.

[*Pseudohazis eglanterina* var. *shastaënsis* BEHRENS, N. Amer. Ent., 1 (1880), p. 62.]
[*Pseudohazis shastaënsis* DYAR, Psyche, May, 1894, p. 91.] Proc. U. S. Natl. Mus., XXVII (1904), p. 792.

[P. *eglanterina*, form alt. *shastaënsis* Behrens.

Similar in maculation to *eglanterina*, the whole upper surface of primaries however largely suffused with black; in extreme forms the only traces of ground color are found in a row of interspacial yellow or pink spots in the terminal area, and even these may possibly at times disappear; ordinarily there are several pink or yellow patches in the median area around and below the discocellular spot and a dash of ground color at base of wing, as well as distinct large terminal patches. Beneath the black suffusion is not so extended, and the majority of specimens appear but slightly darker than the type form.

Described from 8 ♂ ♂ in collection Barnes from Plumas County, Cal. (9,000 feet, July), (Garner); Fort Klamath, Oreg.

J. McDunnough.]

[A letter from Jas. C. Cottle to Dr. Packard, May, 1904, states that a single female *P. shastaënsis* laid eggs which produced "four aberrations, two blacks and two reds." Probably the forms of this moth will be found to exhibit mendelian segregation. Mr. Cottle adds that eggs of *P. shastaënsis* were laid July 12, 1902, and the larvæ emerged April 21, 1903. He had taken full-grown larvæ and moths on the same day.]

[James Behrens wrote, December, 1889, of a "Wonderful large-sized var. *shastaënsis*, quite black." He added: "The female *shastaënsis* is more like the common *eglanterina*, but very conspicuous for its deep cherry-red tints, together with the usual yellow parts.]

[I have received the eggs of this species from Mrs. S. J. Kidder, who has very kindly taken the trouble to find them and forward them to me in good condition. They were received in the fall of 1892 and hatched on May 11 following.

Eggs.—Deposited in a ring-shaped mass around a leaf stem or twig, without covering. Oval, flattened at the sides, round on the base, but flat on top, forming a distinct, elliptical area, slightly depressed centrally at the micropyle. Smooth, shining, pale brown, covered with a white pigment below and on the narrower sides and forming a distinct ring around the top surface, inside of which is a dark brown border. Height 1.8 mm.; broad diameter centrally 1.6 mm., at top 1.1 mm.; narrow diameter centrally 0.8 mm., at top 0.7 mm. Duration of this stage throughout the hibernating period.

Larva.—Stage I: Head round, bilobed, shining black; antennæ prominent; width 0.7–0.75 mm. Body dull black, feet reddish. Rows of modified processes, apparently arranged as in the mature larva, but only three rows discernible. Row i very long, rather slender, the anterior ones distinctly furcate or trifid, each branch with a very long, minutely spinulose, pale seta, even longer than the shaft. The processes are shorter posteriorly, not furcate, though many bear two of the long setæ. Row ii shorter than i with a seta from the middle and one from apex. Row iii very short, but many of the tubercles bear two setæ. Anal plate concolorous with anal feet. Duration of this stage 13 days.

Stage II: Head shining black, labrum and bases of antennæ paler; width 1.0–1.2 mm. Body black, the tips of the spines straw colored. Processes very long, especially on joints 2–4 dorsally, where they are 1.5 mm. long. The others are nearly as long, but become gradually shorter posteriorly. The processes bear about six branches and are furcate at tip, each branch bearing a single pale, stiff hair, longer than the branch itself. The branches arise alternately. Anal plates three, large, black; one suranal, the others at base of each anal foot.

Stage III: Head depressed medially, shining black, clypeus whitish; width 1.4–1.8 mm. The characters of the mature larva are now first seen. Body black, the processes of row i with a short shaft on joints 4–12 and close-set branches, each tipped with a short, black bristle or a long, pale seta. The branches are brownish yellow, contrasting with the body. The other processes have a long, thick shaft and separated branches as all did in the previous stage. Rather scant, pale hairs arise from the skin.

Stage IV: Much as in the next stage, but darker, more shining, the body less hairy, and without any distinct lines. Width of head 2.2–3.3 mm.

Stage V: Head rounded, median suture deep in front, clypeal sutures double; many coarse pale hairs. Color shining black, shaded with dull crimson on clypeus; width 3.7–4.5 mm. Processes arranged as follows: row i subdorsal on joints 2–11, a single dorsal one on joints 12 and 13, none on anal plate; row ii lateral, on joints 2–13; row iii substigmatal on joints 2–13; row iv above bases of legs on joints 2–4 and correspondingly on joints 5, 6, 11, and 13 anteriorly. There are three forms of the processes. The first, rosette-like, has a very short shaft with some 50 light brown quills with short black tips, which probably produce the strong urticating effect, besides a few central black branches which bear long terminal hairs. This type is found in row i on joints 4–12. The second is intermediate. The shaft is long with brown quills arranged around the base and some 10 black spines with terminal hairs, branching irregularly from the

shaft and usually forming a trifid or bifid apex. This type is found in row i on joints 2, 3, and 13 and in row ii on joints 2–13. In the third form there are no quills, the long shaft furnished with irregularly distributed, subradiate branches tipped by long hairs. The branches are black; but many are partly or wholly light brown. This type is found in rows iii and iv. Three shining black, irregularly indented, hairy anal plates, and a large rounded quadrangular cervical shield bearing the processes of rows i and ii on joint 2. Body black with faint subdorsal and lateral and broader substigmatal, sinuate lilac lines, or nearly immaculate. Hair from the skin white, not long, but quite abundant, giving a grayish appearance to the larva. Spiracles reddish white with a black line centrally. Claspers of abdominal feet tinged with dull crimson.

Cocoon.—Very slight, composed of a few threads drawing together loose material or, more commonly, none. The larvæ conceal themselves, but do not enter the earth.

Pupa.—Rounded conical, thickest through the thorax, tapering posteriorly. Cases large and prominent, but very even and closely packed. Anterior end rounded; posterior end also rounded, much smaller. Segmental incisures abrupt, not deep, with little capability of motion. Cremaster reduced to a bunch of short hairs on a slight prominence, colored red-brown, curving outward. Surface finely granular. Color dark mahogany red, the cases a little paler. Length 25 mm.; width through thorax 9 mm.; through abdomen at second movable incisure 7 mm. Four incisures are well-marked; but the posterior one is scarcely movable, being coarsely punctured, while the others are smooth. Imago in about 50 days after pupation.

Food plants.—Ceanothus, Arctostaphylos, etc. Fed in confinement on cultivated cherry. Larvæ from Watsonville, Cal. Others seen, but not bred, at Yosemite and Monterey, Cal., and Portland, Oreg. The larvæ are gregarious till quite large.—H. G. Dyar, Psyche. May, 1894, pp. 91–92.]

PSEUDOHAZIS SHASTAËNSIS var. DENUDATA (Neumœgen).

[*Pseudohazis eglanterina* ab. *denudata* Neumoegen, Canad. Entom., XXIII (1891), p. 145.]

[Neumoegen's original description is as follows:

Head, thorax, primaries and secondaries above and below of rich yellow; nearly denuded of all markings. Abdomen yellow with black segmentary bands. Primaries, black costa, a beautiful rose tinge at base and along costa to apex, as well as along interior margin. Apical tip black, fading inwardly; a little black dusting, indicating location of discal spots and costal terminus of mesian bands respectively. Submedian cells tinted with light rose. Secondaries with black costa and black dusted discal spots. Very faint indication of mesian band and basal black field. Below, primaries and secondaries uniformly rich yellow, with rose tints at apical part of costa of primaries, and on upper half of secondaries. Abdomen tinted with rose; costa of primaries pronouncedly black, and black spots indicating costal terminus of mesian band and discal spot. Secondaries, costa black and light black indications of mesian band and discal spot. In both wings the nervures are accentuated with black, especially at intersection with exterior margins; black marginal lines and yellow fringes.

Habitat, California.

Type, ♂. Collector, B. Neumoegen.

The specimen figured in Strecker's Rhopal. and Heter., No. 15, Plate XV, figure 9, but not described, is an Ab. *denudata*, with markings a little more pronounced than in my specimen.]

PSEUDOHAZIS HERA (Harris).

Plate XXV, fig. 4; LXII, figs. 8, 9, 13.

[*Saturnia hera* Harris, Rep. Ins. Mass. (1841), p. 286, note.]

[Kirby states that this species was figured by Audubon, Birds Amer., III, Pl. 359 (1837).

Hemileuca pica Walker, Cat. Lep. Het. B. M., VI (1855), p. 1318, is given by Kirby and Dyar (as *picta*) as a synonym of *hera*, but Neumoegen (1891) listed it as a variety of *P. eglanterina*, and it is so placed in J. B. Smith's list of 1891.]

[♂. Head and thorax deep yellow, patagia pale lemon-yellow; abdomen deep yellow dorsally ringed with black and often with a distinct dorsal row of pale yellow spots, which tend to expand laterally, forming a posterior margin to the black banding; beneath whitish-yellow, banded more or less distinctly with black and with a lateral row of black spots; legs deep yellow; upper side of both wings pale lemon-yellow; primaries with a broad black basal dash, not attaining antemedian band: antemedian and postmedian bands black, broad, of equal

width, the former is outwardly oblique in course, slightly angled inwardly in the cell, not prominently bent as in *eglanterina;* the latter is bent outward below costa, then slightly sinate to inner margin, at times very close to antemedian band; a large black discocellular patch, often coalescing basally with postmedian band, and generally more oblong than in *eglanterina;* a pale central lunule may or may not be present; a terminal series of black dashes along the veins, more or less triangular in shape and usually attaining the postmedian band; costal and terminal borders narrowly black.

Secondaries either with a black antemedial band or the whole basal area of wing black; a broad postmedial black band angled opposite the cell, and a large discocellular black oblong patch the ends of which are mostly coalescent with the postmedian band, inclosing a pale yellow spot situated in the angle of the band; terminal area of wings as on primaries; ♀ similar to ♂; the black banding rather broader and more diffuse, giving a general blacker appearance. Underside in both sexes practically identical with the upper side, ground color slightly whiter. Expanse, ♂ 52–62 mm.; ♀ 58–69 mm. There is considerable tendency toward melanism, shown in the broadening of the black bands and the suffusion of the lower portion of the median area with black.

Described from 17 ♂ ♂, 3 ♀ ♀ in collection Barnes, from Glenwood Springs, Colo. (Barnes), (August 8–30); southern Utah (Poling), (August); Reno, Nev. (Barnes).—J. McDunnough.]

P. hera was taken by Snow in Gallinas Cañon, N. Mex. (Cockerell in litt.).

[Mr. A. L. Siler wrote to Dr. Packard in 1890, that between Mount Pleasant and Spring City, Utah, on a blustery day, very cold for the season, he came on a flock of black and white moths (*P. hera*); they were as abundant as red-legged grasshoppers. One was sent to Dr. Packard.] The young were received from Mr. C. A. Wiley, Miles City, Mont., May 29, 1896.

Larva.—Stage III: Length 12–15 mm. They are exactly as in stage IV?, but without the lateral whitish line. The body is not very thick and is more as in *H. maia* than in *A. io.*

Stage IV?: Length 25–30 mm. Head shining black, the clypeus anterior rather prominent and full; body dull black, the only markings being a lateral very sinuous cream white somewhat livid line, interrupted by the tubercles, and extending from the third thoracic to the eighth abdominal segment. The two dorsal prothoracic spines are like the lateral ones, while the two dorsal meso- and meta-thoracic spines are shorter by about one-fourth and with more numerous spines at the base (as in the other species), and the same series along the abdomen are about one-half as long as the lateral ones, with thickset spines, no scattered ones as on the lateral spines. *All the spines and spinules are black,* but the hairs arising from them are white, giving the animal a frosted appearance. The two dorsal spines on the third thoracic segment have one spinule bearing a hair, the abdominal ones (1–8) have four to five such white piliferous spinules.

The caterpillar in this stage does not prick when roughly handled. After teasing one and roughly handling it for half an hour I could not detect the eversible glands, and they seemed at this age to be functionless.

Habits.—Mr. Wiley writes me that the caterpillars "hatch in the fall or very early in the spring and make their first appearance about this time (May 22). I have seen two colonies of them on the sage brush so far this spring. *Hera* is diurnal in flight. I believe I sent you some of them once, stating that I believed them to be *Coloradia pandora,* but have reared them since and to my surprise they turned out to be *hera.* The eggs are deposited at or under the root stalk of the sage brush in a cluster somewhat similar to that of *Clisiocampa.* I have never seen larvæ of *C. pandora* nor do I know its food."

[The following description by Dr. Packard has a marginal note in pencil "*P. eglanterina?* from Dyar (from Montana?)—probably *hera?*" I wrote Dr. Dyar, who says, "The larvæ from Montana from C. A. Wiley were never bred or connected with adults, I think."]

Stage I: Ten living examples described May 29. Length 4 mm. Body rather longer and slenderer than young *H. maia* or *A. io.* Head a little wider than the body, the latter a little thicker on the thoracic segments than toward the end of the abdominal region. Head shining black, with scattered golden-yellow hairs of unequal length; anterior edge of clypeus pale.

Body dull brown-black, with a slight reddish tinge, with no stripes or spots, but the skin is somewhat rough; the sutures between the segments are paler, being dark flesh-colored. The spine like tubercles are long and *all over the body*, are uniformly dull brown-black, and giving origin to golden-yellow hairs which are about twice as long as the spines from which they arise. Suranal plate and anal legs of the same color as the body.

The dorsal thoracic spines (on each of the three segments) are longer and larger than the others behind and deeply forked, those on the prothoracic segment being 3-forked, as also subdorsal ones, while those on the second and third thoracic segments are bifurcate. They are about as long as the body is thick. Abdominal dorsal spines considerably shorter than the thoracic one, simple at tip, with a tine lower down. On the eighth and ninth abdominal segments is a bifurcate median spine. The spines are rough, tuberculated, but shining black. The thoracic legs are black, the middle abdominal ones dark flesh-colored, the under side of the body dull flesh color.

Stage II: After the first molt, June 9–10. Length, 10 mm. Head and body still black, but while the subdorsal and lateral spines are still black, as also the two dorsal prothoracic ones, the spinules around the base of the second thoracic spines are bright ochreous yellow as are the whole of the dorsal, third thoracic ones, and all the abdominal ones, thus the *back of the larva behind the prothoracic segment is gamboge-yellow, where before it was nearly all black.* The skin of the body instead of being black is dark livid purple, including all the abdominal legs, the thoracic legs being shining black. Also the armature has now changed, the dorsal third thoracic and abdominal spines being more *verticillate and bushy*, the central two of the spinules being black, the others yellow; *they are not much more than half as high as the first and second thoracic dorsal spinules.*

PSEUDOHAZIS HERA var. MARCATA Neumoegen.

[*Pseudohazis hera* var. *marcata* Neumoegen, Canad. Entom., XXXIII (1891), p. 146.]

[Neumoegen's original description is as follows:

Antennæ dark brown. Head, prothorax, patagia, and legs light yellow. Thorax the same, with blackish ground. Abdomen white, with black segmentary bands; lower border of each segment as well as anal tuft of bright yellow. Primaries pure white. Costa, apices and fringes black. The intersection of each nervure at exterior margin accentuated by black dashes, pointing inwardly. A prominent black mesian line and a large black discal spot, faintly showing the white kernel. A basal dash encircled by a black outwardly curved line from inner margin to costa, terminating in an irregular costal spot.

Secondaries pure white with black marginal line and fringes interspersed with black, a large black discal spot and mesian line; the latter curved outwardly near median nervure so acutely as to give the line nearly a triangular shape. In some specimens the ends of discal spot are confluent with mesian line. Below, primaries and secondaries pure white, with markings as above. Abdomen with black lateral dots and black segmentary bands. Secondaries with black costa and termini of nervures slightly tipped with black; a black irregular line encircling basal space.

Types. Coll., B. Neumōegen.

Habitat, Klamath County, Oreg.

This handsome variation is so decidedly marked as to be distinguishable at first glance from the typical *hera* by the entire absence of black terminal dashes of nervures of secondaries and the lack of black basal tinges.

I have about 50 specimens before me all uniform in appearance.]

MEROLEUCA Packard.

[*Mesoleuca* Packard, Journ. N. Y. Ent. Soc., XI (1903), p. 247, not of Hübner.]
Hemileuca Walker, in part, Cat. Lep. Het. Br. Mus., VI (1855), p. 1319.
[*Meroleuca* Packard, Journ. N. Y. Ent. Soc., XII (1904), p. 250.]

Male closely allied to *Hemileuca*, but differing in the larger, longer palpi, the shorter wings, and in the venation.

Head as in *Hemileuca*, hairy and shaggy in front, of about the same width between the eyes, which are of the same size as in *Hemileuca*. The antennæ differ in the joints being longer, so the pectinations are farther apart, but in their length and hairiness the two genera are similar. Palpi much longer and more distinct than in *Hemileuca*, projecting well beyond the front, but the hairs on them are bushy or shaggy and irregular. The thorax and abdomen are as in *Hemileuca*.

Fore wings rather shorter and broader, and the hind wings broader and rather more rounded at apex. The hind wings extend as far as the end of the abdomen. The venation in general is as in *Hemileuca*, but with the notable difference from any other genus of Hemileucidae that vein II_5 arises rather far from the origin of III_1, far from the discal veins; the latter also are oblique, especially the posterior one. Hind wings with the discal veins very oblique, the other veins much as in *Hemileuca*.

Markings: Wings all pale, tending to ochreous whitish, the veins being dark, distinct; no discal spot and no bars, only a submarginal brown line common to both wings.

There are no long flattened hairs on the thorax.

The type of this genus is *Hemileuca venosa* Walker.

The species is confined to northeastern South America, *M. venosa* occurring in Venezuela (Caracas) and Colombia (Bogotá). My example was compared with Walker's type in the British Museum, and the localities mentioned are from the labels in that museum.

MEROLEUCA VENOSA (Walker).

Plate LII, fig. 7.

Hemileuca venosa Walker, Cat. Lep. Het. Br. Mus., VI, p. 1319, 1855.

Imago.—One ♂. Head and body vandyke brown. Prothoracic collar dull ochreous. Both wings uniformly pale ochreous whitish, but the veins contrast with the ground color in being brown, as is the fringe. No discal spots, though there is a slight tendency for the pale ochreous scales to be thicker over the discal veins. A slightly sinuous submarginal diffuse brown line parallel with the outer edge of both wings; the line is a little wider on the hind than fore wings. Hairs on the fore tibiæ somewhat yellowish.

Beneath as above, costa of fore and hind wings a little more ochreous than the rest of the wings. End of the abdomen reddish, much as in *H. maia*.

Expanse of fore wings, ♂ 49 mm.
Length of fore wing, ♂ 25 mm.
Breadth of fore wing, ♂ 13 mm.
Length of hind wing, ♂ 21 mm.
Breadth of hind wing, ♂ 15 mm.

HELICONISA Walker.

[*Heliconisa* Walker, Cat. Lep. Het. Brit. Mus., VI (1855), p. 1333.]
[Type *H. impar* Walker.=*Nyctemera pagenstecheri* Geyer.]

Imago.—♂. Head quite wide in front; vestiture thick and full, much as in *Pseudohazis;* eyes not very large. Antennæ of ♂ just as in *Hemileuca* and *Pseudohazis*, quite long and moderately wide, pectinated to the tip; the branches curved upwards near the base; only a single pair on each joint, the distal ones wanting. Palpi scarcely distinguishable from the front, weak, drooping, the hairs long and irregular; the joints not distinct, much as in *Pseudohazis*. Thorax wooly and shaggy.

The wings are perfectly transparent so that every vein is naked, the scales being confined to the edge of the wings, where the squamation is thin, but naturally thickest and densest along the costal edge. No discal spots or scales. Fore wings moderately pointed at the apex, which is not quite so sharp, while the outer edge is not so oblique as in *Pseudohazis*. Hind wings rather long, longer than in *Pseudohazis* and rounder on the inner angle.

Venation: [Dr. Dyar finds that veins 9 and 10 (III_3 and III_2) of the fore wings are absent. A sketch supplied by him represents 7 and 8 (III_5 and III_4) present, joining nearer to apex of cell than to apex of wing; 6 (IV) arising from upper corner of cell; 5 (IV_2) from middle of apical side of cell, midway between 4 and 6; 3 (V_1) arising from lower side of cell, as far from 4 as 4 is from 5.]

Fore legs provided with a tibial process or elongated sack, about three-fourths as long as the tibia itself. Abdomen rather slender, not reaching so near the inner angle of the hind wing as in *Pseudohazis*.

The wings are transparent, without the usual markings, no lines or discal spot; the veins are naked and Japan-brown and are very distinct. The scales are dark brown and tawny, rather long and hair-like on the inner edge of the hind wings.

The genus is remarkable for the rather slender body, the large wings, transparent and scaleless except on the edges, the naked very distinct veins, and for the two large tibial sense-sacks on the fore legs. The antennæ are almost exactly as in *Hemileuca* and it evidently is an aberrant member of the family. Its larval history would be most interesting.

Geographical distribution.—Restricted to Brazil.

HELICONISA PAGENSTECKERI (Geyer).

[*Nyctemera pagensteckeri* Geyer, Samml. Ex. Schmett., III (1837?).]
[*Heliconisa*] *impar* Walker [Cat. Lep. Het. Br. Mus., VI (1855), p. 1334].
[*Heliconisa*] *impar* Kirby, Syn. Cat. Lep. Het., I [p. 787].

Imago.—One ♂. Body, antennæ and veins Japan varnish in color. The wings of both pairs transparent, nearly scaleless, with no spots, bars, lines, or any other markings. Costa of the fore wings tawny on the basal half, brown beyond. Outer edge of both wings brown-black, interrupted by tawny yellow spots at the ends of the veins. Beneath a rich golden yellow tint along the costa of both wings; costa of hind wings more scaled than on fore wings.

Expanse of fore wings, ♂ 92 mm.
Length of fore wings, ♂ 49 mm.
Breadth of fore wing, ♂ 25 mm.
Length of hind wings, ♂ 40 mm.
Breadth of hind wing, ♂ 27 mm.

Geographical distribution.—Espiritu Santo, Brazil; Province of St. Paul, Brazil.

PSEUDAPHELIA W. F. Kirby.

[*Pseudaphelia* Kirby, Cat. Lep. Het., I (1892), p. 771.]
[*Aphelia* Westwood, Proc. Zool. Soc. Lond., 1849, p. 61, preoccupied.]
Heniocha Herrich-Schaeffer, Samml. Aussereur. Schmett., p. 60; 1855 [not of Hübner].

Imago.—♂. Head with the front as in *Heliconisa*, but more squarish, it is hairy, but the hairs are not so long as in *Hemileuca* and *Pseudohazis*. Eyes moderately large. Antennæ of ♂ subplumose as in *H. maia*, but the branches are rather slender, and the joints are unusually long and slender; there is only a single pair to a joint, and they are well ciliated. Palpi moderately large, extending beyond the front; second joint broad, and the third distinct but short, with long hairs beneath.

The wings are very thinly scaled, semitransparent; veins dark and distinct. Fore wings rather short and broad, subrectangular at the apex; outer edge much shorter than the inner. Hind wings round on the outer edge and on the apex; rather more produced at the inner angle.

Fore tibial sack large, naked, as long as and wider than the fore tibiæ; arising from the base.

The abdomen is rather slender, closely, finely scaled, only reaching halfway to the inner angle of the hind wings.

Markings: Wings thin, whitish; veins very distinct; ground color whitish. Fore wings with two ocelli. One common linear scalloped submarginal line. Abdomen with close finer scales, with a dorsal and lateral row of black dots.

Geographical distribution.—Durban, Natal. [Abyssinia, according to Kirby].

This is a remarkable genus, the type of a group distinct from *Heliconisa*, and is the only member of the family occurring beyond the limits of South America or the Neogaeic realm. Although so aberrant, it seems to belong in the Hemileucidæ, or at least may provisionally be placed here.

If it should prove to be a Hemileucid, it affords another instance of the relationship of the South American and South African faunæ.

PSEUDAPHELIA APOLLINARIS (Boisduval).

Plate CX, figs. f–j.

[*Saturnia apollinaris* Boisduval, Delegorgue, Voy. Afr. Austr., II (1847), p. 601.]
Heniocha paleacea Herrich-Schaeffer, Samml. Aussereur. Schmett., p. 60, ♂, fig. 308, 1855.

Imago.—One ♂. Antennæ black, body and wings at base snow-white, clouded on the costa and outer edge, two yellow discal spots in the center of the wing, each encircled with a dusky smoke brown ring. No ocellus on the hind wing. A submarginal dusky linear scalloped line common to both wings; six scallops in fore wing, and seven in hind wing. Edge of wing dusky, with a distinct straw-yellow spot at each end of the vein in both wings, divided by the vein and appearing as if double, there are seven of these spots on the fore wing, and seven on the hind ones. The wings are marked below as above, but rather less distinctly so. Abdomen white, with a dorsal and lateral row of black dots.

Expanse of fore wings, ♂ 58 mm.
Length of fore wing, ♂ 32 mm.
Breadth of fore wing, ♂ 20 mm.
Length of hind wings, ♂ 28 mm.
Breadth of hind wings, ♂ 20 mm.

Geographical distribution.—Durban, Natal.

Pupa.—Thick, short, with a remarkably long, slender, acute, straight anal spine.

Subfamily Saganinæ Packard.

Head broad in front, triangular, narrowing decidedly towards the mouth, the vestiture long, shaggy, and partly concealing the eyes, which are rather small. Antennæ of male broadly bipectinated to the tip, the joints (about 23–24 in *S. sapatoza*) are unusually long and the pectinations are also unusually long, and are straight as in *Ormiscodes, Hylesia,* etc., not curved near the base as in the normal Hemileucidæ; the distal pair of pectinations are as long and large and densely ciliated as those of the basal pair; only the last joint without pectinations; those of the ♀ with short pectinations.

Palpi short, weak, porrect, not reaching the front; the vestiture long, thin, bushy and so confounded with that of the front, that they can not be easily detected. No traces of maxillæ visible.

Body moderately thick; abdomen conical, short, not reaching much beyond the basal two-thirds of the inner edge of the hind wings.

Fore wings in ♂ unusually falcate, the costa much curved toward the apex, which is much produced, moderately rounded, not square as in *Holocera,* and not so narrow and pointed as in *Micrattacus.* Outer edge deeply excavated; inner angle not rounded, unusually square. Those of ♀ subfalcate, wide.

Hind wings distinctly triangular; costal edge full, convex; outer edge very slightly excavated; inner angle rounded; inner edge straight.

Venation: Veins II_1 and II_2 [III_1, etc., in revised nomenclature] absent, the discal veins situated in the outer third of the wings. Hind wings: Vein III_2 not forming an independent vein, not being detached from III_1. (For other details see the generic characters.)

Legs long and slender, no fore-tibial epiphysis.

Sagana is evidently a very much modified form, and should with our present knowledge, there being only two species known, be regarded as the type of a distinct subdivision of the Hemileucidæ, although at first sight it seems to have no affinities with this family. The amount of degeneration in the venation, the broadly pectinated antennæ, the lack of a fore-tibial epiphysis, and the peculiar discal clear lunate or oval spots, the presence of an apical mark like that of Saturnians, are noteworthy features. The subfamily characters are the same as the generic ones, and are subject to future revision. The discovery of the larva and a knowledge of its transformations are much to be desired.

Geographical distribution.—Neogaeic in its range. The only genus known occurring in Mexico, Colombia, and Venezuela.

SAGANA Walker.

Sagana Walker, Cat. Lep. Het. Br. Mus., V, p. 1235, 1855.
Sagana Kirby, Syn. Cat. Lep. Het., I, p. 754, 1892.

Imago.— ♂. Head rather narrow, with long spreading hairs concealing the small short palpi. Antennæ broadly pectinated to the tip; distal branches as long as the basal ones, except at tip, which is hardly subfiliform. Legs very hairy; tarsi with long hairs on the outside.

Fore wings very falcate; costa much arched toward the apex; outer edge deeply excavated, the apex being much produced, though not acute at the tip, but rounded. Hind wings reaching much beyond the end of the abdomen, nearly a third of their length; triangular, as broad as long, wider than the fore wings.

Venation: Very remarkable from its specialized and degenerate nature, there being no veins II_1 and II_2; veins II_3 and II_4 arising at a point opposite the origin of the anterior discal vein and also that of veins III_1 and III_2; the stalk of veins II_3 and II_4 originates at about the middle of the discal cell; veins III_1, III_2, III_3 and IV_1 are all very short, the outer end of the discal cell being situated near the outer third of the wing; the two discal veins taken together form a long curved fine line forming the axis of the peculiar crescentiform discal spot, while in *Cyrtogone* the origin of vein IV is remote from that of vein III_3, in *Sagana* the two veins have a common origin. Hind wings somewhat as in *Micrattacus*, but vein III_2 is not detached from III_1, otherwise as in the fore wing, the discal cell being large, wide, and the outer side situated at the outer third of the wing.

Markings: Very remarkable discal spots which are large, lunate, semiopake, alike on both pairs of wings, traversed by the slender discal veins; a subapical triangular black and blue spot edged with white.

Legs long and slender, fore tibia long and slender when denuded, and in ♂ with no trace of a tibial epiphysis.

The ♀, judging by Felder's figure of *S. semioculata* (Pl. LXXXVII, Fig. II), has antennæ with short pectinations; fore wings wide, subfalcate; the discal spots on the fore wings wide, narrow, oval; fully half as wide as long on the hind wings; the apical spot present. The abdomen only reaches half way to the end of the hind wings.

This is a remarkable generic form in which (*S. sapatoza*) there is a striking degree of specialization of the discal spots. The wing membrane of these scaleless areas is dense and rough like thin parchment, and they are of very unusual shape. The degree of specialization and in some very important points of degeneration is striking also as regards the venation. Veins II_1 and II_2 being both absent, a unique feature in the Hemileucidæ (except *Pseudaphelia* where they are absent). They are also absent in the Saturnian genera *Perisomena* and *Caligula*, *Graellsia*, and *Callosamia*. The other distinctions as regards the venation above noted, and the absence of the fore tibial epiphysis, as well as the peculiar discal spots, are exceptional features. The discovery of the larva is most desirable.

Geographical distribution.—This genus ranges over Central America, extending from Mexico to Colombia and Venezuela.

It represents in the Neogaeic realm the south African *Holocera* and *Ludia*.

SYNOPSIS OF SPECIES.

Fore wings broad, not very falcate; discal spots oval, not lunate.....*S. semioculata.*
Fore wings very falcate; [discal spots] large, lunate, scaleless.....*S. sapatoza.*

SAGANA SAPATOZA Westwood

Sagana sapatoza Westwood, Ann. Mag. N. H., 2d ser., XV, p. 299.
Sagana sapatoza Walker, Cat. Lep. Het. Br. Mus., V, p. 1235, 1855
Sagana sapatoza Kirby, Syn. Cat. Lep. Het., I, p. 754, 1892.

Imago.—One ♂. Body and wings uniformly bright olive greenish with a yellowish hue. The short hairs on the antennæ and the legs are pink-red, except the hairs of the femora, which are concolorous with the head.

Fore wings with two narrow dark-brown lines, the basal one a little nearer the discal spot than the base of the wing, slightly sinuous and curved in on the costa. The outer line somewhat sinuous and irregularly scalloped, beginning on the outer third of the inner edge and ending near the apex. Discal spot of singular shape and appearance; it is rather large, lunate, incurved, about four times as long as wide, and square where it rests on the base of vein III_3, and pointed at the front end; the membrane is opaque, like thin parchment, with a median impressed line (the discal veins); there are no scales upon it, and it is narrowly edged with brown. A small triangular apical black spot, with a few scattered blue scales and still fewer bright Indian red scales, and edged broadly behind with white. Apex and edge of wing clear olive green, base of costa as far as the basal line ash-brown. Hind wings marked like the fore wings and of exactly the same hue, but the extradiscal line is more deeply scalloped; the discal spot is as large as on the fore wings, but more regularly curved at each end.

Under side of the wings with a reddish brown tinge; discal spots the same shape and structure; extradiscal line more deeply scalloped, and that on the fore wings with oblique scallops. Apical spot about half as large as above.

Expanse of fore wings, ♂ 80 mm.
Length of a fore wing, ♂ 37 mm.
Breadth of a fore wing, ♂ 17 mm.
Length of a hind wing, ♂ 25 mm.
Breadth of a hind wing, ♂ 20 mm.

A very conspicuously marked species.

Geographical distribution.—Santa Fé de Bogotá, Colombia (Mus. de Hist. Nat. Paris).

SAGANA SEMIOCULATA Felder.

Sagana semioculata Felder, Reise der Novara, Zool. Theil, Bd. II, Abth. 2, Tab. LXXXVII, fig. 4, 1874.
Sagana semioculata Kirby, Syn. Cat. Lep. Het., I [p. 754].

Imago.—One ♀. Antennæ with short pectinations. Fore wings broad, costa not much arched; apex not sharp, outer edge slightly excavated behind the apex. Hind wings more rounded, less triangular than in ♂. Discal spots narrow, oval in fore wings, not lunate; in the hind wings oval, about twice as wide as long, the outer side straight, inner side convex or rounded. A basal and extradiscal line. An apical triangular spot with a much smaller one behind it. Extradiscal line on the hind wings much scalloped and accompanied beyond with a series of dark lunules. This is apparently the more primitive and generalized species of the two thus far known.

Geographical distribution.—Venezuela (Felder).

Subfamily Holocerinæ Packard.

Head of moderate size, rather large; the front rather narrow, narrowing somewhat toward the labial region; vestiture uneven, shaggy; when denuded the front is flat, narrow, about twice as wide across the vertex as at the oral edge.

Antennæ of ♂ bipectinated, the joints in *Henucha* numbering 32; the distal fourth filiform. The pectinations are double, the distal pair very slender, thin and closely appressed to those of the basal pair of the next joint. Antennæ of ♀ well pectinated, nearly as widely as in the ♂ (*Henucha* and *Ludia*).

Palpi short, not very porrect, a little depressed and bushy, not reaching the front (*Henucha, Ludia* and *Holocera*). When denuded very small, vestigial, pear-shaped and pressed against the infra-oral region. Maxillæ not visible, obsolete, with no trace unless a microscopic oval process on each side of the mouth be their vestiges.

Body moderately stout; thorax not very thick, abdomen tapering to the end (*Henucha, Holocera*). The hind edge of the ninth abdominal tergite is armed with 10 uneven slender acute spines, the shortest ones being those in the middle (*Holocera*).

Fore wings much more falcate than usual, the great elongation of the apex being carried to an excess in *Holocera;* the apex itself is obtuse, roundish; the outer edge is below the apex deeply excavated; the inner angle is somewhat rounded.

Hind wings short, distinctly triangular; the costal edge unusually convex; the apex much rounded; outer edge deeply excavated especially in *Holocera;* abdomen not reaching beyond the hind wings.

Venation: Vein III_2 in wings of both pairs being entirely independent, as in *Hylesia,* the discal veins taken together forming a line directed a little inward, or especially in the fore wings of *Holocera* still more so and situated quite far out beyond the middle of the wing, so that the veins beyond III_2, III_3, IV_1 are very short. In the hind wings the vein III_2 forms an independent vein; the discal veins taken together forming a line either bent or curved outward. Vein II_2 always wanting.

Legs long, slender, hairy, vestiture not dense and closely cropped, but sparingly hairy, the hairs inclined to form a lateral fringe on the tibiæ and tarsi. The fore tibial epiphysis is large, long and sack-like, nearly two-thirds as long as the long, slender tibiæ (*Holocera*).

Genitalia exhibit no distinctive subfamily characters, but are quite closely related to those of *Anisota* as regards the suranal plate (especially *A. virginiensis*), which ends in two black chitinous lobes, in the form of the claspers, of which there is but a single pair, and in the penis and triangular upper plate.

Larva.—[See under *Holocera smilax.*]

[*Geographical distribution.*—South Africa to Cameroons (*Ludia orinoptera* Karsch).]

SYNOPSIS OF THE GENERA.[1]

Fore wings moderately falcate; apex obtusely pointed; large ocelli on hind wings.....*Henucha.*
Fore wings remarkably falcate, costal edge concave; apex squarish, no ocelli on hind wings.....*Holocera.*
[A penciled note adds:] *Ludia* is a synonym of *Henucha.* [But in the fuller treatment beyond they are kept separate.]

HOLOCERA Felder.

Holocera Felder [Reise d. Novara, Lép., IV (1874)].
Bolocera Kirby, Syn. Cat. Lép. Het., 1892.
Holocera Aurivillius, Ent. Tidsk., XIV, p. 201, 1893.
Bolocera Rothschild, Nov. Zool., II, p. 50, 1895.
Holocera Karsch, Ent. Nachrichten, XXII, p. 252, 1896.

Imago.— ♂. Head in front subtriangular, not very narrow, moderately broad; eyes rather large. Antennæ broadly pectinated at base, subfiliform or serrate on the outer third; in ♀ nearly filiform; less widely pectinated than in *Ludia* or *Sagana.* The antennæ are described from Felder's figure, being lost in my male.

Palpi not distinct, the hairs loose and not distinguishable from those of the front, the palpi not being long enough to reach the front.

Fore wings long and narrow, excessively produced, the apex being long drawn out, much more so than in *Ludia,* the costa much arched toward the apex; the outer edge deeply excavated; in ♀ the wing is much broader, the apex wider but more pointed, and the outer edge is but slightly excavated. Hind wings triangular, rounded on the apex, somewhat produced at the inner angle, reaching as far as the end of the abdomen; in ♀ also a little produced and reaching to the tip of the abdomen.

Venation: Near that of *Ludia,* vein II_1 as in *Ludia,* no vein II_2, but differing in the following respects: The origin of vein III_1 is close to that of the anterior discal vein, the latter arising inside of it, not some distance beyond the origin of III_1, as in *Ludia;* the posterior discal vein is curved inward; in the hind wings the veins given off from the outer side of the discal cell are longer, their origin nearer the middle of the wing.

[1] [The genus *Carnegia* Holland (Entom. News, 1896, p. 134), from the Cameroons, looks like an extreme development of the Holocerine type, with a wing form rather approaching that of the neotropical *Teratopteris.* I have examined the type of *Carnegia mirabilis* Holl., in Dr. Holland's collection. It is a very distinct and remarkable form; the antemedian band is of quite a different form from that of *Holocera;* wings of both pairs multifenestrate; apex of primaries strongly falcate; anal angle of secondaries strongly produced; postmedian band of primaries strongly scalloped. The thorax is wholly without the broad light collar of related genera. The venation is figured by Holland (l. c.), as also the pupa. Strand (1910) has described a second member of the genus, *C. geniculipennis.*]

Markings: A singular transparent discal spot on fore wings, which is subtriangular, scalloped on the outer edge and with a sinus on the inner side; a small obscure lunate discal spot on the hind wings. In this genus the fore wings are still more produced toward the apex than in *Ludia;* the outer edge more deeply hollowed out, while the hind wings are not so broadly triangular, and the veins are beyond the discal cell shorter, and there are minor differences in the venation shown in the figures.

Geographical distribution.—[South Africa.]

HOLOCERA SMILAX (Westwood).

Plate XXXIII, fig. 9; CXI, figs. a, b.

[*Saturnia* (*Henucha?*)] *smilax* Westwood [Proc. Zool. Soc. Lond., 1849, p. 59].
[*Bolocera smilax*] Kirby, Syn. Cat. Lép. Het., I [p. 774].

LARVA.

[Fawcett, Trans. Zool. Soc. Lond., XVII, p. 171, Pl. VI, fig. 35.]

Imago.—♂. Body and wings reddish chestnut brown, fore wings with two light pink red lines close to the discal spot, the inner oblique, not wavy, the outer sinuous, approaching near the inner behind the discal spot, and bent inward on the costa, the space thus inclosed is darker reddish brown, as is the apical region. Discal spot large, transparent and of singular shape, being subtriangular, with three scallops on the outer edge and a very deep or close narrow sinus on the inner edge. Hind wings with a small obscure curved narrow crescentiform discal spot, white, broadly edged with dark reddish brown. Extradiscal line sinuous.

Under side of the wings a little clearer, so that the lunate discal spot on the hind wings shows much more distinctly than on the upper surface.

Expanse of fore wings, ♂ 55 mm.
Length of fore wing, ♂ 26 mm.
Breadth of fore wing, ♂ 10 mm.
Length of hind wing, ♂ 16 mm.
Breadth of hind wing, ♂ 10 mm.

Geographical distribution.—[Natal.]

Larva.—Last stage (one specimen in formalin): Length 45–50 mm.; thickness 11 mm. Lieut. Col. Fawcett's figure, presumably of natural size, is 75 mm. in length.

Head of the same shape as in *Automeris io, Hemileuca,* etc., a little more than one-half as wide as the prothoracic segment and narrowing above; surface smooth, without the groups of granulations nearly always present in the Bunæinæ; chestnut brown, shining. Antennæ large and long as in American Hemileucidæ.

Only six tubercles on each thoracic and abdominal segment. They are rather large, prominent, rounded, conical, and do not give rise, as in the American genera, to a single spinulated spine, but on the crown are 10 to 20 separate spiniferous warts. On the prothoracic segment are two small low flattened tubercles bearing 9–10 warts, each giving rise to a slender, sharp, spine-like seta, the setæ radiating from the tubercle, as in all the others. The supraspiracular tubercle (on the side) is large, prominent, and, like all the others on the body behind it, is reddish chestnut at base and blackish on the crown. It is as large as any of the dorsal ones on the segments behind, and bears about 20 long sharp spine-like setæ, which are dull reddish, tipped with black; the longer spines (in my single example) are about as long as the tubercle is high. On all the succeeding segments, thoracic and abdominal, are similar rather large conical tubercles, like haycocks in shape, each bearing about 10–15 setæ. Those of the two dorsal rows are all of nearly the same size and height, those on the second and third thoracic segments being but slightly larger than the abdominal ones. A median tubercle on eighth abdominal segment, which is wider but not larger than those on second and third thoracic segments, rounded conical, showing no signs of its double origin, except from above, where the spine-like

setæ appear to be grouped into two lateral sets of about 8 or 9 each. The two dorsal tubercles on the ninth abdominal segment are wide apart and of the same size as those of the supra-spiracular row; they bear 15 setæ, arising as do those of all the other tubercles from minute conical warts.

Suranal plate very short and broad, scarcely half as long as broad, the end very blunt, as in Hemileucid larvæ generally; on each side near the end is a tubercle bearing about six to eight spiniferous warts, and farther in toward the base on each side and situated in the large central black spot is a minute tubercle bearing three setæ.

Body clothed with rather dense white hair-like setæ; they are thickest on the sides, about as long, some a little longer, than the tubercles are high. There is another set of remarkable setæ scattered sparingly, especially on the sides of the body. They are long, slender, delicate, finely spinulated setæ, the spinules very slender and fine, and thrown off at an angle from the main shaft, so that they are not exactly feather-like or plumose.

The body is (in my formalin example) orange-red with numerous irregular dark spots all over each segment, like the spots on a leopard, the interior pale bluish gray, and the black edge bordered with pale gray or pearl color; there are about 15 such spots, some of them mere dots, on each segment between the spiracle and the median tergal line. Along the body is an interrupted broken line of similar median spots. Spiracles black. Anal legs rather small, as in other Hemileucidæ, triangular, the center black, with numerous warts. Thoracic legs chestnut red; midabdominal legs with a black shining spot above each planta.

Lieut. Col. Fawcett describes the larva thus: "Ground-color rufous with irregular pale blue spots surrounded by a thin white line. On each somite a short tuft of black hairs, surmounted by a tuft of longer and finer hairs of same color, and the first five and last somites covered with short yellow hairs. Head, legs, and claspers brown." He states that the larva "looks, through a microscope, like a piece of old chinaware in color," and adds that it "is one of the most unpleasant larvæ to handle that I have ever met with. The short black hairs on each somite possess poisonous qualities, which produce on the hand a white rash akin to that produced by a bad stinging from nettles."

Judging from Fawcett's figure I referred the larva to the Hemileucidæ, but on receiving the specimen he kindly sent me for examination I felt in doubt, as I could not see the two or three long hairs arising from the tubercles. In all the Hemileucid larvæ from America which I have seen the tubercles extend into a more or less high spinulated spine; those of *Holocera* are probably more primitive or generalized in this respect than any Hemileucid larvæ yet known to me.

At any rate the study of the larva of *Holocera* is of great interest as bearing on the diagnostic features of the family and the value of the larval characters, which in this case are congruous with those of the pupa, cocoon, and imago. The family characters of a median-sized head, narrowing above, surface smooth, without granulations; large long antennæ, a short broad, not heavily tuberculated suranal plate, and anal legs of moderate size, are those which at once separate the larvæ from those of the Sphingicampidæ (Citheroniinæ, Agliinæ, Bunaeinæ), and definitely establish the family rank of the Hemileucidæ.

The African genus *Holocera* differs a good deal in the tubercles, these being rounded conical, not sending up a branching spine, the 10–20 spines (much more numerous, three to four times, than in any Bunaeinæ) all arising separately from the crown of the tubercle. This sort of tubercle may either be a generalized or primitive condition, or it may be the result of reduction or extreme specialization, as the moth in the shape of the wings and their markings appears to be.

That the insect is also a Hemileucid is shown by the very poisonous spines and by the fact that the larva spins a cocoon. The pupa is not yet known.

Cocoon round, cylindrical, formed of its [larval] hairs. Food plant, oak, also feeds on the jasmine (*Jasminum pubigerum*, D. Don).

Geographical distribution.—Durban, Natal (Fawcett, Queckett).

HENUCHA Geyer.

Henucha Geyer, Sammlung exot. Schmett., III, ? 1837.
Henucha Walker, Cat. Lep. Het. Brit. Mus., VI, p. 1331, 1855.
Ludia Felder, Reise d. Novara, Lep., IV, 1874.
Ludia Maassen and Weymer, Beitrage Schmett., V, 1886.
Henucha Kirby, Syn. Cat. Lep. Het., I, p. 774, 1892.
Henucha Rothschild, Novitates Zoologicæ, II, 1895.

[Type of genus *H. grimmia* Geyer.] Rothschild gives two species, *H. grimmia* Geyer and *H. dewitzi* (Maas. and Weym.). [*H. hansalii* Felder is a *Ludia*, as originally described.]

Imago.— ♂ and ♀. Head wide in front, much as in *Ludia*, but the hairs longer and forming a radiating mass, concealing the short feeble palpi (which are difficult to distinguish in the specimens examined). Antennæ broadly bipectinated; 20 sets of pectinations, which are stout and densely ciliated; tip subfiliform, consisting of 10 or 11 joints, with minute vestigial branches. No maxillæ visible. Thorax stout; abdomen small, conical, both as in *Ludia*.

Fore wings differing from those of *Ludia* in being much less falcate, though the costa is but little less arched, the outer edge is entire, straight (not curved) not deeply excavated.

Hind wings not triangular as in *Ludia*, but broad toward the inner angle; apex much rounded, and costa full and convex, much as in *Ludia*.

Venation: Vein II_1 arises much as in *Holocera*, beyond the origin of III_1 (or third subcostal branch), otherwise the venation is much as in *Ludia*, the anterior discal vein from vein III_2 (fourth subcostal) a considerable distance beyond its origin. The minor differences can be observed by an examination of the figures; the venation of the hind wings much as in *Ludia*.

Markings: Ground color brown and ochreous; ocellus of wings of each pair of a very unusual pattern, each one containing a circle of metallic silvery scales.

Geographical distribution.—Ethiopian realm, Cape Colony.

SYNOPSIS OF [SUB-]GENERA.

Fore wings very falcate, outer edge deeply excavated; hind wings triangular.....*Ludia*.
Fore wings scarcely falcate; hind wings broad, apex much rounded; ocellus containing a silver circle.....*Henucha*.

HENUCHA DEWITZII (Maassen and Weymer).

Ludia dewitzii Maassen and Weymer, Beiträge z. Schmett., Leif V, figs. 90, 91, 1885.
Henucha dewitzi Kirby, Syn. Cat. Lep. Het., I, p. 774, 1892.
Henucha dewitzi Rothschild, Novitates Zool., II, 1895.

Imago.—Two ♂ and one ♀. Male: Head and body ochreous; hairs at the base of the antennæ and on each side of the front dull pink red. Legs brown above, dull pink red beneath. Thorax yellow, with a transverse brown stripe in front, and three longitudinal ones, the patagia being brown. Abdominal segments ochreous mixed with brown.

Fore wings brown mixed with olive scales; costal edge dull pink. Two very distinct pale ochreous cross lines, basal line broad, sinuous, making two large scallops; the extradiscal line nearly touching the ocellus, it is a little sinuous, and scalloped on the inner edge; edge of wing also pale ochreous, interrupted by the veins. The ocellus is formed by an outer narrow ochreous ring, within which the surface is black, inclosing a very distinct metallic silvery looking ring free from scales, it is not quite circular and is sometimes open externally; the black within this ring is centered with yellow.

Hind wings pink, but brownish beyond the extradiscal line; the edge and fringe pale ochreous. Ocellus much larger than that on the fore wings, the ochreous ring wider, with black outside, the silvery ring entire. A dark patch on the inner edge inside of the extradiscal line.

Beneath as above, but each of the four silvery rings are imperfect, open on the outer side. Fore wings pink red at base and along the inner edge. Hind wings with brown and green scales, but pinkish along the inner edge. The lines as above, but no basal lines on either wing.

Expanse of fore wing, ♂ 52 mm.
Length of fore wing, ♂ 23 mm.
Breadth of fore wing, ♂ 10 mm.
Length of hind wing, ♂ 15 mm.
Breadth of hind wing, ♂ 12 mm.

A very beautiful and strikingly marked moth, with most highly specialized ocelli.

Geographical distribution.—Cape of Good Hope (Maassen and Weymer), Schaus collection, (American Mus. Nat. Hist.) no locality given.

LUDIA Wallengren.

Saturnia Boisduval [in Delegorgue, Voy. Afr. Austr., II (1847), p. 601].
Saturnia Westwood [Proc. Zool. Soc. Lond., 1849, p. 59, Pl. 10, fig. 4].
Henucha Walker [Cat. Lep. Het. Brit. Mus., VI (1855), p. 1332].
Ludia Wallengren, Vet. Akad. Hansl., (2), V (4), p. 25, 1865.
Ludia Rothschild, Nov. Zool., II, p. 50, 1895.

Imago.— ♂ and ♀. Head broad between the eyes, with dense short scales, Antennal joints rather long, with about 14 pairs of pectinations, in ♂ filiform on the distal third of their length; distal pectinations as long as the basal ones, but about half as thick, all densely ciliated, the two pairs of pectinations are close to each other, gaping or diverging at the ends; on the filiform tip the branches are represented by denticulations, the teeth ending in fine setæ; in the ♀ (?)[1] the antennæ are widely pectinated, with 14 pairs, the filiform tip is one-fifth as long as the entire antennæ, and only two (?) other basal pectinations are present. Palpi short, not distinguishable from the front, and not reaching it. Thorax stout, clothed above and beneath with long hairs ending like a battledore or tennis racket.

Fore wings long and narrow, much produced toward the appex in ♂, much less so in ♀; costa well arched; outer edge deeply excavated in ♂, but little so in ♀. Hind wings reaching a little beyond the tip of the abdomen in ♂, as far as the tip in ♀.

Venation: In most respects more aberrant than in *Micrattacus;* vein II_1 arises far beyond the discal cell, and between the origins of III_1, and II_4; no vein II_2. III_2 is widely detached from III_1, and forms an independent vein; the two discal veins of the same length, not forming either a curved or oblique line; the independent (III_2) and vein III_3 and IV_1 very short; the outer side of the discal cell (along the median vein) being situated in the outer third of the wing. Hind wings with the discal cell extending to the outer third, and the veins extending from it very short; the posterior discal vein incurved and long. The minor differences from *Henucha* are shown in the figures.

Markings: The genus is at once distinguished not only by the narrow and very falcate fore wings, but also by the singular upsilon-shaped transparent discal spot on the fore wings. On the hind wings is a large discal ocellus centered with black, and surrounded with a wide black circle; it is nearly obsolete beneath. Legs rather hairy, not very thick.

The peculiar markings, especially the upsilon-like discal spot and the long narrow fore wings, which are produced toward the apex to an unusual extent, as well as the unusually broadly pectinated antennæ of the female, and the place of origin of vein II_1 are the distinguishing features of this genus. The ♀ antennæ are so broadly pectinated, so closely resembling the male in this respect, that without examination of the genitalia, it would be mistaken for a male. Westwood, however, says that the female antennæ are not "very shortly pectinated on each side;" indeed, they are unusually long, though shorter than in the male.

Geographical distribution.—So far as known the species are confined to Natal, or the coast region of southeastern Africa. According to Rothschild, this genus is represented by four species: *L. delegorguei* (Boisd.), *L. hansali* Felder, *L. obscura* Auriv., and *L. dentata* Hampson.[2] [*L. delegorguei* is the type of the genus.]

[1] I don't understand why this female has antennæ so well pectinated, if it is the same species as my male.
[2] [Strand, in 1911, described *L. limbobrunnea, L. nyassana, L. tanganyikæ, L. pupillata, L. luciphila,* and *L. delegorguei* ab. *vetusta.*]

LUDIA DELEGORGUEI Boisduval.

Plate XXXI, fig. 7; LXXX, fig. 8; CXI, figs. c–g.

[*Saturnia*] *delegorguei* Boisduval [in Delegorgue, Voy. Afr. Austr., II (1847), p. 601.]
[*Henucha delegorguei* Fawcett, Trans. Zool. Soc. Lond., XVII (1903), p. 172, Pl. VI, fig. 36. Larva.]

Imago.—One ♂, one ♀. Body and wings dark fawn brown, including the head, antennæ, palpi, and abdomen. Fore wings with the basal line oblique, not wavy; extradiscal line sinuous, making a great curve before reaching the costa; the wing between these two lines is darker than the base or the outer edge of the wing, though the apical region is nearly as dark. In the ♀ there is more gray in the basal part just beyond the extradiscal line and along the costa. A slight oblique gray apical streak. Discal spot upsilon-shaped, or like a short T with long down-curved arms; it is transparent, clear of scales, and of a most unique shape. Hind wings brown, but pink at the base and on the costal region, but not on the inner edge of the wing. Discal spot bright yellow, surrounded by a diffuse black ring, wider in ♀; the yellow centered by a much curved lunate black line containing a narrow transparent clear line; beyond, in the yellow field, is a diffuse whitish streak.

Under side of the fore wings tinged with deep carmine pink on the inner edge, otherwise as above, including the discal spot. The hind wings beneath are in ♂ the color of a dead leaf, mottled with light and dark fawn brown; ♀ the same, but grayer and somewhat frosted, with faint traces of a discal spot, represented by a minute curved dark line, including a few white scales.

In ♀ the fore wings are much broader, with more gray scales on the costa and on the outer side of the extradiscal line, and the pink at the base of the fore wings outside of the discal spot is paler than in the ♂, with more gray and white scales beneath and above, presenting a more frosted appearance.

Expanse of fore wings, ♂, 42 mm.; ♀, 56 mm.
Length of fore wing, ♂, 22 mm.; ♀, 29 mm.
Breadth of fore wing, ♂, 10 mm.; ♀, 15 mm.
Length of hind wing, ♂, 14 mm.; ♀, 17 mm.
Breadth of hind wing, ♂, 10 mm.: ♀, 15 mm.

Geographical distribution.—Natal.

Larva.—Length, 50–55 mm.; width of head, 5 mm. Head, dark chestnut red, rather hairy; the hairs white. Body cylindrical, rather thick, ground color "yellowish white" (Fawcett); very hairy.

Prothoracic segment with two low conical setiferous tubercles, one above and one below the spiracle, but situated on the front edge; the median dorsal tubercles are obsolete as such, but there are numerous setiferous warts. The hairs are rather long and thick, unequal in length, scattered among the tubercles. There are four tubercles (eight in all on each segment) on each side of the second and third thoracic segments, and three on each side of the abnominal segments. All the tubercles are low, rounded, conical and densely beset with setiferous warts; the setæ are of two kinds, those arising from the center or middle of the crown being long, white, rather thick hair-like setæ of unequal length and forming a thin tuft, the longest hairs nearly half as long as the body is thick; the others are stiff dark, sharp poisonous spines, about a dozen radiating outward from the edge of the crown of each tubercle. The abdominal tubercles are very slightly smaller than the thoracic ones, but the spines radiate, and do not stand erect as in the tubercles of some American Hemileucids.

The two dorsal tubercles on the eighth abdominal segment are slightly higher than those in front, but not so large as those on the ninth segment, and they are closely *approximate*. but yet separate; they each bear from 10 to 12 black or pale radiating spines.

Suranal plate short and broad, the hind edge rounded, the surface hairy; the white hairs are of different lengths, arising from pits and minute warts. Near the hinder end are four groups or pencils of long white (three to four) hairs, the four pencils arranged in a line extending across

the posterior fifth of the plate. Spiracles black. Directly below the spiracles are two to three conspicuous black spots, forming a broken lateral line of such spots. Another more connected line of irregular black spots along the base of the legs, both thoracic and abdominal. Thoracic legs reddish, abdominal legs concolorous with the body. Anal legs pale, very hairy on hinder edges.

The larval characters of this genus show that it is a Hemileucid, but the tubercles are either primitive or reduced, at least much modified compared with those of the American genera.

[Larva received] from J. M. Fawcett.

Family SATURNIIDÆ Walker.

Attaci (*Phalæna*), in part, Linn., Syst. Nat., vol. 5, p. 2400, 1767.
Larvæ verticillatæ, in part, Denis and Schiff, W. V., p. 49, 1776.
Bombycites Legitimæ, pt., Latr., Gén. Crust. et Ins., IV, p. 217, 1809.
Bombycidæ (Stirps II *Verticillata*), part, Horsfield, Cat. Lep. Mus. E. I. Co., pp. 24, 27 [1828?].
Bombycidæ Stephens, part, Ill. Brit. Ins., Haust., II, p. 35, 1829.
Bombycida Duncan, pt., in Brewster, Edin. Encycl., IX, p. 131, 1830.
Phalænæ et *Phalænites*, Newm., Sph. Vesp., p. 45, 1832.
Saturnides Boisduval, Ind. Méth., p. 73, 1840.
Attacites Blanchard, Hist. Nat. des. Ins., II, p. 361, 1845.
Attacidi Stephens, Cat. Br. Lep. Br. Mus., p. 44, 1850.
Saturnidæ Walker, List. Lep. Het. Br. Mus., pt. V, p. 1198, 1855.
Saturniina Herrich-Schaeffer, Lep. Exot. Sp., p. 60, 1858.

[The following discussion was published in Proc. Amer. Acad. Arts and Sciences (n. s.) XX (1893), pp. 55–58:]

The larval characters of the members of this interesting group, especially those features which are congenital, tend to show that the family has originated from some spiny group, and most probably, when we take into account the transformations of *Aglia tau*, from the Ceratocampidæ, although none of the latter spin a cocoon. During the evolution of the group they underwent a change in shape, from a rather long and slender form to a thick heavy body, with a thin integument, the result perhaps of an unusually stationary mode of life. The imagines also underwent a process of degeneration, as seen in the atrophy, total or partial, of the maxillæ, and in the loss of veins in their very large but weak wings; though the loss of strength of flight is somewhat compensated for by the remarkable development of the olfactory organs, or antennæ.

This family also appears to be a closed type, viz, none of the higher or more specialized Bombyces appear to have descended from it (unless possibly the Cochliopodidæ), the type representing a side branch of the Bombycine tree which late in geological history grew apart, and reached a marked degree of modification, resulting in the possession of adaptive characters which were not transmitted to later forms. It seems probable that the type was a Miocene Tertiary one, which has lingered on in eastern America (north and south), and in eastern Asia, as well as in Africa, while it has become nearly extinct on the Pacific shores of North and South America, and in Europe.

Saturnia (*in its restricted sense*) *the most generalized genus of its family.*—In the European *Saturnia carpini* and its allies, and our Pacific coast species, *Saturnia mendocino* and *S. galbina*, the larva of the former species having been described by the late Henry Edwards (Proc. Cal. Acad. Sci., Dec. 17, 1877), we have perhaps the most generalized and primitive members of the family. In the larva of *Saturinia carpini*, for a specimen of which I am indebted to M. P. Chrétien, of Paris, the setiferous tubercles are of the same size and shape on the abdominal as on the thoracic segments, there being no differentiation in shape and size or color, such as occurs in all the other genera, except that the second and third thoracic dorsal tubercles bear one or two bristles much longer than those on abdominal segments 1 to 7, and about as long as those on the eighth abdominal segment. There are *six* tubercles on this (eighth) segment, being the same number as on the seven segments in front; on segment 9 there are four tubercles, and two on the tenth segment, i. e., the suranal plate. The same number of tubercles on the eighth abdominal segment also occurs in *Saturnia mendocino*[1] of California. Likewise the same number is present in the European *S. pyri*, judging by the figure and description in Duponchel et Guenée's Iconographie (II, Pl. I), and the statement, "On ne compte que quatre tubercules sur le premier anneau, de même que sur le dernier, tandis que les intermédiaires en ont chacun six." It is also figured in Hübner's Schmetterlinge.

[1] We copy Mr. Edwards's description of this larva, to show that the same characteristic of *six* tubercles on *all* the abdominal segments 1 to 8 occurs in the Pacific coast species of the genus: "*Full grown.* Head small, rough, purplish brown, somewhat withdrawn into the second segment. Ground color of the body, pale yellowish green. On the second and anal segments are four tubercles each, bright orange-red, with black hairs springing from them, and on each of the other segments are six similar tubercles, those of the anterior four being the largest. Head and body thickly clothed with whitish hair. Laterally there is a pale yellowish fold above the spiracles, which are orange with a darker ring. Feet and underside purplish brown. Length 2.25 inches. Food plant, *Arctostaphylos tomentosa.*"

Indeed, the extremely generalized form of the larvæ of this genus is clearly shown by the fact that in *P. cecropia*, and all the other more specialized and hence later genera, there are only five tubercles on the eighth abdominal segment, those corresponding to the two middle ones of *Saturnia* having, probably during embryonic growth, coalesced. The embryos of these moths should therefore be examined shortly before hatching to ascertain whether this be not the fact. Meanwhile it is not unreasonable to suppose that all the more specialized genera must have been derived from a *Saturnia*-like ancestral form, i. e., a larva of cylindrical shape, with all the tubercles, whether thoracic or abdominal, of the same size, shape, and color on all the segments; those on the eighth abdominal segment being of the same number (six) as on the segments in front.

The single median tubercle on the eighth abdominal segment of the more specialized Saturnian larvæ represents the "caudal horn" of Sphinges, *Bombyx mori*, and the Notodontian genus *Pheosia*, and is evidently the result of fusion before the end of embryonic life of what were originally two separate tubercles, like the two separate ones of *Saturnia*. We are thus able to confirm the suggestion of W. Müller, who first identified the "caudal horn" with the two dorsal tubercles on the eighth abdominal segment of the Saturniidæ.[1]

Thus as regards the tubercles the species of *Saturnia* are on the same plane with the embryo, just before exclusion, of the more highly specialized forms of the group Attacinæ. The great size of the Attacinæ, particularly *Attacus atlas*, appears to be a sign of recent specialization, and the small size of *Saturnia*, aside from its other features, suggests that it is a generalized form, not departing greatly from the normal size of the members of the superfamily Bombyces.

And here an interesting problem in zoogeography occurs. Are the species of *Saturnia* (in the restricted sense)—three in Europe, and two in the Southwest and Pacific coast of North America, occurring where the Attacinæ do not exist at all, or only rarely—the relics of a Saturnian fauna from which the group Attacinæ has been eliminated by geological extinction, as the sequoia, cypress, magnolia, and other Tertiary plants have been rendered extinct in Europe, or may the view be taken that the Attacinæ have never had a foothold in Western Eurasia and North America?

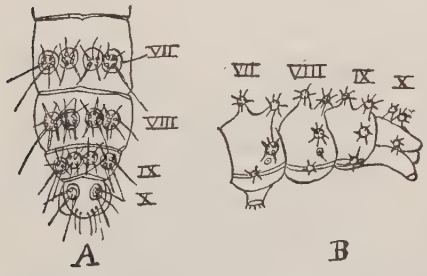


Fig. 16.—A, a dorsal view of the end of the body of the larva of *Saturnia carpini;* B, the end of the body of *S. pyri*, copied from Duponchel.

Should we use the characters drawn from the number and arrangement of the tubercles of the larva in classifying the Saturniidæ, we might divide the family into two groups, as follows:

A. Six tubercles on the eighth abdominal segment; the tubercles in general over the body all of the same size. Generalized forms. Subfamily 1. *Saturniinæ.*

B. Five tubercles on the eighth abdominal segment, the median one double; the tubercles in general more or less differentiated or specialized in size and color. Specialized forms. Subfamily 2. *Attacinæ.*

An interesting series of parallelisms may be observed in comparing the early and later stages of the larvæ of this family. For example while the late embryos of the Attacinæ are perhaps paralleled by the fully grown larva of *Saturnia*, the fully grown larva of the most or one of the most generalzed *Attacinæ*, *Samia*, is on the same plane of specialization as the larva of *Callosamia* in its third stage.

[The following appeared in Psyche, March, 1902, p. 321:]

The subfamily Saturniinæ, characterized by having six separate tubercles (the two median ones being separate) on the eighth abdominal segment, comprise the following genera: *Perisomena*, *Cricula*, *Saturnia* (I can not see that *Calosaturnia mendocino* differs from *Saturnia*), *Heniocha*, *Loepa*.

The following genera belong to [Attacinæ] * * * beginning as heretofore with the most generalized forms, the exact sequence being subject to further modification: *Copaxa*, *Opodiphtera*, *Tagoropsis*, *Syntherata*, *Rhodia*, *Rinaca*, *Neoris*, *Caligula*, *Graellsia*, *Argema*, *Actias*, *Tropæa*, *Antheræa*, *Telea*, *Metosamia*, *Callosamia*, *Samia*, *Epiphora*, *Philosamia*, *Rothschildia*, *Coscinocera*, *Attacus*.

This subfamily is divided into several, at least five groups of genera in two series, for example, a *Copaxa* group, an *Antheræa* group (*Antheræa*, *Telea*, *Metosamia*); a *Samia* group (*Samia*, *Epiphora*, *Callosamia*), a *Tropæa* group (*Graellsia*, *Argema*, *Actias*, *Tropæa*), and an *Attacus* group (*Rothschildia*, *Philosamia*, *Attacus*).

Whether *Rhodia*, *Rinaca*, and *Neoris* belong with *Loepa*, which has six tubercles on the eighth abdominal segment, or with *Copaxa* which in stage I has but five, the median one being double, remains to be seen after we know more of their larval forms.

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[1] W. Müller, Südamerikanische Nymphalidenraupen, 1886, pp. 249, 250. Müller remarks:

"So erscheint es berechtigt, für das Schwanzhorn der *Sphingidæ* die gleiche Genese anzunehmen wie für den unpaaren Dorn der *Saturniadæ* auf 11. Beide sind entstanden aus den Stützgebilden der beiden Borsten 1 auf Segment 11. . . . Weiter finden sich bei einer Raupe, augenscheinlich den Saturniden angehörig, in einem früheren Stadium *Sds* auf 2, 3, *Ds* 11; mit der nächsten Häutung versch-winden die sämmtlichen Dornen. Bei *Brahmea ledereri* finden sich im 3. (.) Stadium *Ds* 11, *Sds* 2–10, 12, *Sst* 4–11, von welchen Dornen die *Ds* 11, *Sds* 2, 3 stark entwickelt, die anderen klein, unscheinbar sind. Im 4. (?) Stadium sind die *Ds* 11, *Sds* 2, 3 wohl entwickelt, die anderen Dornen sind kaum nachweisbar. Im letzten Stadium bleibt nur eine Warze an Stelle des *Ds* 11; es erhält sich also der Rest von *Ds* 11, am längsten.

"Mir scheinen alle diese Gründe zur Annahme zu drängen, dass das Schwanghorn der Sphingiden der Rest einer reicher entwickelten Bedornung ist, einer Bedornung, nie vielleicht mit der heutigen der Saturniden auf gleichen Ursprung zurückzuführen ist, so dass das Schwan-horn der Sphingiden und der *Ds* dorn der Saturniden im vollen Sinn homolog sind."

See also E. B. Poulton in Trans. Ent. Soc. London, 1885, p. 302, and in later papers; also A. S. Packard, Proc. Bost. Soc. Nat. Hist., XXV, 1890, pp. 79-103, foot-notes 1, 2, 3. Also compare our Figures 3–6, 8–10d', and the references to them in the text. Also Grote's N. A. Lepidoptera, Bremen, 1886, pp. 16, 54.

[Dr. Packard has since described the larva of *Rhodia*, showing that it has a single median dorsal tubercle on the eighth abdominal segment. Mr. J. H. Watson (litt. 1912) states that in *Cricula trifenestrata* there are two penultimate tubercles, but in *C. andrei* there is only one.]

[Mr. C. L. Pollard (litt. 1912) would restrict the Attacinæ to *Coscinocera*, *Attacus*, *Rothschildia*, *Philosamia*, *Epiphora*, *Samia*, *Callosamia*, and *Eupackardia*. This includes the "*Samia* group" and "*Attacus* group" of Packard.]

PERISOMENA Walker.

[*Perisomena* Walker, Cat. Lep. Het. Brit. Mus., VI (1855), p. 1276.]

PERISOMENA CÆCIGENA (Kup.).

Plate XXX, figs. 8–9; XXXVIII, fig. 2; C, fig. 2.

[*Saturnia cæcigena* Kup., Neuentdecktes Nachtpflauenauge, 1825, p. 1. A species of southeastern Europe and western Asia.]

[Egg glossy, flat, and marbled with white and brown; several deposited together.—Jordan.]

Larva.—(Zeller's collection; two blown specimens.) Small, two inches long; body cylindrical, hairy; six rows of tubercles, all small, rounded, and not prominent; the dorsal ones of second and third thoracic segments only a little larger than the abdominal ones, and all four of the same size; one on side low down, but none on dorsum of prothoracic segment. On eighth segment six tubercles, the two dorsal ones remote from each other, twice as large as those on the side. Body and base of legs covered with dense fine piliferous tubercles. Color uniformly pale horn brown, with no bright markings, lines, or spots. Head darker than body. [Jordan says: Larva first bluish gray, then green, more rarely reddish, the hairs white, the small warts yellow, below the stigmata a raised longitudinal line.]

Cocoon.—Open, can see pupa through. [Color dark brown.]

Pupa (two broken pupa skins).—Rather stout, end of abdomen truncated-flattered, and with a stout hook on each side, curving inward. [Food plant, *Quercus*.]

Perisomena is near *Opodiphtera astrophela* (Walker) (*simplex* (Walker)), from Australia.

Polythysana from Chili (*P. rubrescens*) I have from Paris Museum is near this *Perisomena*. [*Polythysana* was however provisionally left in the Agliinæ by Dr. Packard. The opinion here given is from a small slip of paper, under the above description of the larva of *Perisomena*.]

CRICULA Walker.

Plate LXXXIV, fig. 3; CI.

Cricula Walker [Cat. Lep. Het. Brit. Mus., V (1855), p. 1186.]

Euphranor Herrich-Schaeffer, Samml. Aussereur, Schmett., p. 61, no description; fig. 80; 1854.

[Dr. Dyar writes that *Euphranor* included *trifenestrata* Helf. and *multifenestrata* H.-S.; the title page of the work is dated 1850–1858. Kirby gives 1858 for *multifenestrata*. *E. multifenestrata* is herewith designated as the type of *Euphranor*, which thus becomes a synonym of *Copaxa*.]

LARVA.

[Jordan, Nov. Zool., XVI (1909), p. 300; Stebbins, Entom. News., 1910, p. 101; Watson, Entom. News., 1910, p. 255; Watson, Internat. Ent. Zeits., February, 1912, p. 343.]

Imago.—♂, ♀. Head narrowing perceptibly in front, so that it is triangular and rather narrow. Eyes large. Palpi well developed, depressed, the ends pointed, extending below the edge of the front of the head. Maxillæ not visible in specimens with the scales undisturbed. Antennæ of the male broadly pectinated to the tip, the joints long, the pectinations of both pairs of the same length and with long cilia. Those of the female have but one pair of short slender pectinations, the distal pair wanting, the vestiges of them appearing as slight teeth; of the basal pair the inner ones are about one-fourth shorter than the outer ones, and all end in three or four short setæ.

Fore wings falcate, especially in the male; the costa is much curved toward the apex; the outer edge is excavated in the ♂, scarcely so in ♀; the inner edge is nearly as long as

the outer edge. Hind wings triangular, slightly produced toward the inner angle; the apex well rounded; the outer edge full and convex; the inner edge nearly straight. Abdomen of the ♂ not extending much beyond the middle of the inner edge.

Markings: Ground color dull yellow ochre, more or less tinged with lilac brown. No ocelli, but on the fore wings are two or three small irregular or round clear spots.

On the hind wings a minute dark solid discal dot. An extradiscal line common to both wings; a basal line on the fore wings, and on the hinder pair a submarginal scalloped line. The species of a little less than median size.

Geographical distribution.—Northeastern India, Khasia Hills; Java; Burmah (Swinhoe).

[Jordan in his revision of the genus (Nov. Zool., 1909) recognizes the following forms:

C. andrei Jordan. Sikkim, Bhutan, and Assam.
subsp. *elaezia* Jordan. Java.
C. trifenestrata (Helfer). Assam to Java, Borneo, etc. (syn. *burmana* Swinh.).
subsp. *ceylonica* Jordan. Ceylon.
subsp. *agoia* Jordan. Travancore.
subsp. *luzonica* Jordan. Northern Luzon.
subsp. *andamanica* Jordan. Andamans.
C. drepanoides Moore. Sikkim and Bhutan.

Watson (1912) adds *C. andrei* var. *vinosa* Watson (♀).

C. zuleika (Westw.) was described in *Saturnia*, and the name is preoccupied. It was based on male *andrei* and male *trifenestrata*, the latter being regarded as the female.]

CRICULA TRIFENESTRATA (Helfer).

Plate XXXI, figs. 1–6; XXXVIII, fig. 3; CI.

Saturnia trifenestrata Helfer, Journ. Asiat. Soc. Bengal, VI, p. 45, No. 10, 1837.
Euphranor trifenestrata Herrich-Schaeffer, Sammlung Aussereur, Schmett., p. 61, fig. 80, 1854.

Imago.—Two ♂, two ♀. Body and wings tawny or dull yellow ochre, often with a slight grayish or frosty and lilaceous tints. Head, antennæ, and palpi concolorous with the body. Fore wings with a brown zigzag line divided into four scallops. Extradiscal line brown, oblique, distinct, but not wavy in its course, and ending in the costa near the apex. Besides the small half-round transparent discal spot, there are two in front which are solid, opaque and dark in the ♂, with a tendency to become obsolete, but in ♀ there are three larger transparent ones only separated by the veins, and arranged in a slightly curved line.

Hind wings with a distinct straight basal line, and an outer submarginal diffuse zigzag line situated a little nearer the outer edge of the wing than the basal line. A single half-round discal spot in ♀, of the same size as on the fore wing, or reduced in the ♂ to a dark dot.

Under side of the wings of the ♂ lighter than above, with the extradiscal line pale grayish, and scalloped on each pair of wings; the discal and other spots as above.

The ♀ differs from the ♂ in being darker beneath as well as above, and the thorax is deeper ochreous.

The species may be recognized by the row of three transparent spots, of which the discal one is the lowest, the oblique strong extradiscal brown band ending in the costa very near the apex.

Expanse of the fore wings, ♂ 70 mm.; ♀ 75 mm.
Length of the fore wing, ♂ 37 mm.; ♀ 38 mm.
Breadth of fore wing, ♂ 20 mm.; ♀ 21 mm.
Length of hind wing, ♂ 25 mm.; ♀ 25 mm.
Breadth of hind wing, ♂ 20 mm.; ♀ 22 mm.

Geographical distribution.—Khasia Hills (British Museum); mountains of Kawie, Java (Donckier).

Larva.—Body cylindrical, long and slender, hairy, generalized in shape; segments not convex; head small, bright reddish; prothoracic segment with a large hemispherical dorsal

plate, bright coral red, paler than head, the red extending down to lateral distinct tubercles. Body dark brown, with numerous irregular whitish setiferous solid tubercles of varying size; each segment with six large coral red conical tubercles, each bearing a central hair and six stiff spinules, which are much shorter than the hairs. On the eighth abdominal segment is a *double* tubercle, resulting from the partial fusion of the original two tubercles; it is paler red than the single tubercles, each half has a central hair, and six to seven spinules, long and sharp, spreading out. End of body (tenth segment) deep coral red, including anal legs, and without the white filiferous tubercles. All the legs deep coral red. More like an Attacine than a Hemileucid caterpillar.

Cocoon.—Fenestrated, golden yellow. Pupa saturnian-like.

SATURNIA Schrank.

Plate XCIX (*Saturnia* s. str.); C. fig. 1 (*Eudia*).

[*Saturnia* Schrank, Fauna Boica, II)1(, p. 149 (1802).]

[Dr. Packard left a series of notes, which he doubtless intended to rearrange and amplify.]

Imago.—S. pavonia (*carpini*) [=*S. pavonia-minor* (L)] is the most generalized form; reddish-brown fore wing, yellowish hind wing, and in male more yellow beneath. The male is more aberrant than the female, more plastic than in *mendocino,* where the sexes are very closely alike. Antennæ of female with shortest (conical) pectinations. Fore wing falcate, with four bands, five on under side; hind wing with four bands, with a tendency for the fourth or submarginal to be divided into two, the inner side specialized into a band (along discal venule). Ocelli large, alike on both pairs of wings; a central linear or curvilinear mark; there is a tendency for the white scales to fall off and leave nude space. *An incipient subapical eye-patch* (cf *Samia* etc.) in second apical cell. Female abdomen of *S. carpini* and *pyri* banded with white.

In *S. pyri* [=*S. pavonia-major* (L)] the incipient eye is wanting; no red scales, but a subcostal black spot; eyes on hind wing very slightly larger than on fore wing. In *S. pyri* the sexes are colored and marked alike; the female antennæ are well pectinated; the ocelli are more diffuse and specialized than in *S. carpini,* also *more elongated,* the yellow ring replaced by a pale vandyke brown ring, the blue semicircle replaced by white, which absorbs the brown semicircle of *carpini,* and between the white semicircle and the outer black ring is a half ring of brown madder; thus the ocellus is less generalized, more specialized. In *S. galbina* (*Agapema* Neum. and Dyar) the size is small, the colors paler than in *pyri* and *carpini;* the male has four bands, two basal ones separate on under side of fore wings, only two outer bands present; female antennæ well pectinated. The ocelli of *galbina* show a yellow ring inclosing black, crossed by vitreous lines; blue half ring, and outer ring black; the ocellus on hind wing is a little smaller. In *Calosaturnia mendocino* there are no cross bands. In *S. carpini* on under side are five bands or lines on both wings, so that this represents perhaps a more primitive condition than the upper side, and the modification has taken place *from beneath up* (cf Eimer).

Larva.—[Stage I:] Eggs of *S. pavonia-minor* received from Switzerland; hatched out March 25. Head and body jet black, also the hairs; at first after hatching the tubercles and legs are livid greenish-white. Head dull shining black, not bright and smooth. Longer hairs considerably longer than body. Body widest at thoracic segments, thence tapering to end. Two dorsal tubercles on eighth abdominal segment, of the same size and shape as on all the others.

Larva [mature].—*S. spini* has four tubercles on eighth abdominal segment as in *pyri;* the tubercles are red and large, with larger, stouter spines than in *pyri; spini* also is more hairy. The tubercles of *pyri* are simpler, and *spini* is probably nearer to *pavonia-minor.*

[The species of *Saturnia* are listed as follows by Rothschild, Nov. Zool. II (1895), p. 49:]

1. *S. pavonia-major* (L).
2. *S. atlantica* Luc.
   ab. *numida* Aust.
3. *S. pyretorum* Westw. [Jordan has recently placed this in a new genus.]

4. *S. spini* (Den. and Schiff.).
   subsp. *cephaloniæ* Christoph.
5. *S. stoliczkana* Felder.
   [syn. *huttoni* Moore.]
   subsp. *schenki* Staud. [Püngeler (1900) has added a form *galeropa*.] [*S. huttoni* (the type of *Neoris*) has priority of 12 years over *stoliczkana*, so it is necessary to write the species *Saturnia huttoni*, with subspecies *S. huttoni schenki*.] [1]
6. *S. boisduvali* Eversm. [Jordan refers this to *Caligula*.]
7. *S. jonasi* (Butl.) [Jordan refers this to *Caligula*.]
8. *S. pavonia-minor* (L).
9. *S. anna* Moore. [Jordan refers this to *Caligula*.]
10. *S. lindia* Moore. [Jordan refers this to *Caligula*.]
    subsp. *hockingi*. (Moore). [A synonym of *lindia*, according to Jordan, who describes a new subspecies *bonita* from Tibet.]
11. *S. grotei* Moore. [Jordan refers this to *Caligula*.]
12. *S. bieti* Oberth. [Jordan refers this Chinese species to *Caligula*.]
13. *S. medea* Maass.
    [This species, from Ecuador and Peru, has more recently (1911) been separated as a new genus *Saturniodes* Jordan.]
14. *S. galbina* Clem. [type of *Agapema*.]

[Watson notes that the larva of *S. pyretorum* has been figured by Sasaki (1910), and has the tubercles longer and more heavily armed with spines than those of any other *Saturnia* known to him; they are similar to those of *Samia cecropia*.]

[Jordan (in Seitz) regards *S. pyri* (*pavonia-major*) as the type of *Saturnia*, and proposes a new genus *Eudia* for *S. pavonia* (*pavonia-minor*) and *spini*.]

SATURNIA ATLANTICA Lucas.

Algeria, two ♂, one ♀ (Paris Museum). Very near *pyri;* expands only 3½ inches. Evidently derived from *pyri*.

SATURNIA BOISDUVALII Eversmann.

Plate XXXVIII, fig. 1.

[At the Paris Museum Dr. Packard made the following notes, comparing *Agapema galbina* with *S. boisduvalii*:] *Saturnia galbina* represents *boisduvalii* from Kiakhta, Siberie Orientale, but is smaller, and without the zigzag submarginal lines of European and Asiatic species. It comes a little nearer *boisduvalii* than *spini*. In *boisduvalii* the female antennæ are with quite long pectinations.

SATURNIA GROTEI Moore.

Saturnia grotei Moore, Cat. Lep. E. I. Company, II, p. 404, No. 926, 1858. Proc. Zool. Soc. London, p. 265, No. 2, Pl. LXV, fig. 2, 1859.
Saturnia grotei Butler, Illustrations of Lep. Het. Brit. Mus., V, p. 61, Pl. XCIV, figs. 3 and 4, 1881.
Saturnia grotei Kirby, Syn. Cat. Lep. Het., I, p. 772, 1892.

A true *Saturnia*. Four large equal ocelli and apical mark; dark fawn-brown; hind wing rose in middle, including discal spot.

Geographical distribution.—Darjiling (Lidderdale; British Museum).

[The following is referred above to *Saturnia*, but Jordan (in Seitz) leaves it in *Caligula*, as a subspecies of *C. boisduvalii* Ersch.:]

SATURNIA JONASII (Butler).

Caligula jonasii Butler, Ann. and Mag. Nat. Hist. (4), XX, p. 479, 1877. Illustrations Lep. Het. Brit. Mus., II, p. 16, Pl. XXV, fig. 2, 1878.

Geographical distribution.—Yokohama, Japan (Jonas).

[*Saturnia rubella* Dogn. from Peru, is, Dr. Dyar remarks, evidently not a *Saturnia*. It is described as entirely bright rose-lilac, costa pale, faint paler lines and a small faint black discal spot.]

[1] [However, Jordan (in Seitz) now places *huttoni* in *Neoris*. Mr. Watson agrees that *shadula* is to be separated from *Neoris*.]

[Subgenus CALOSATURNIA J. B. Smith.]

CALOSATURNIA MENDOCINO (Behrens).

Plate XLII, fig. 8; LXVIII, figs. 6, 7.

Saturnia mendocino Behrens, Can. Ent., VIII, p. 149, 1876.
[*Calosaturnia mendocino* J. B. Smith, Proc. U. S. Nat. Mus., IX (1886), p. 432.]

[Smith's generic description is as follows:

Head very much retracted; eyes small, narrow, ovate; tongue and palpi entirely aborted; vestiture thin and divergent. Antennæ of male with two branches to each side of each joint, as usual, the pectinations extending to the tip. In the female the antennæ are stout, shortly pectinated to the tip; a single branch only to each side of each joint. Body vestiture hairy, thin, divergent, the thorax comparatively short. Legs short and weak, the posterior pair shortest and weakest; no visible spurs to any pair of legs. Genitalia of male very like those of *Saturnia,* save that the joints of supra-anal plate are not so diverging and not so acute. The side pieces are essentially the same. Primaries with but 9 veins, 5 and 6 together from the upper end of the cell, 7 and 8 on a long stalk from the subcostal. The venation of the secondaries is as in *Saturnia.*]

Generic characters.—Female antennæ with long slender single pectinations, about one-third as long as in male; head narrower than in *Saturnia;* fore wing short; broad, not falcate, outer edge straight compared with *Saturnia;* outer edge of hind wing fuller, rounder, less bent; abdomen not banded with white. Markings differ in absence of bands, and in smaller ocelli. [From a separate memorandum by Dr. Packard. It is uncertain whether he intended to recognize *Calosaturnia* as valid, but as late as 1902 he published the opinion that it did not differ from *Saturnia.*]

Imago.—One ♂, one ♀. Head, body, and wings reddish brown; a broad transverse white band behind the head on the front of the thorax. Abdomen not transversely striped (as it is in *S. carpini.*). Fore wings short and broad, scarcely falcate, slightly flecked with fine white scales; no crosslines or bands; uniformly reddish-vandyke brown; the veins are distinct, the squamation being rather thin. The basal third of the fore wing is dusky, the outer edge of the shade being irregular and passing into the ground color of the wing. Discal spot (ocellus) rather large, round, centered by a small nude white scaleless streak on a black field, the latter inclosed by a snuff-yellow ring of varying distinctness and width; this ring is succeeded by a broad black ring inclosing a fine blue semicircular line on the outer side of the eye; this half circle is not quite half a circle, and is more distinct in the ♀ than in ♂ of my examples. On the inside of the ocellus is an oblong white patch extending from the one side to the other of the discal cell (in the ♀ the white patch is twice as wide on the left as on the right wing). An apical vestigial indistinct spot filling two cells. An outer deep madder red irregular patch, with a blackish irregular shade within, the red almost reaching the edge of the wing, and a diffuse mass of blue scales (perhaps foreshadowing the subapical ocellus of *Samia, Callosamia,* and *Philosamia*).

Hind wings yellow-ochre, vandyke-brown at the base, the brown shade not reaching the ocellus. An outer submarginal broad black band curving around to near the middle of the costa, behind shading into the dark base, so as to inclose a roundish yellow central area, centered by the ocellus. Ocelli very slightly smaller than those of the fore wings (in ♂ of the same size); the eye as in the fore wings, but in ♂ and ♀ the yellow circle is smaller and the outer black circle is wider, and there is no white patch on the inside of the eye.

Under side of the fore wings ocher-yellow, base and outer edge of the wing brownish; ocellus as above; apical spot red and black with some blue scales between the red and black (the subapical ocellus of *Samia* and *Callosamia* in *embryo*). Hind wings nearly all brown, paler than above; a faint yellow area surrounding the ocellus, which is as above. Costal edge of the hind wings white to a point opposite the ocellus. Body brown, legs and antennæ madder-red, the latter paler than the legs.

Expanse of fore wings, ♂ 55 mm.; ♀ 52 mm.

Length of body, ♂ 21 mm.; ♀ 19 mm.

Geographical distribution.—Sonoma County, Cal., (United States Department of Agriculture).

AGAPEMA Neumoegen and Dyar.

Agapema NEUMOEGEN and DYAR, Journ. N. Y. Ent. Soc., II (1894), p. 125.

Dr. Packard left no manuscript on this genus, but so far as he considered it in general discussions, he did not separate it from *Saturnia*.]

AGAPEMA GALBINA (Clemens).

Plate XIV, fig. 6; XLII, fig. 7; LIX, figs. 3, 4.

[*Saturnia galbina* CLEMENS, Contributions to American Lepidopterology, No. 4. Proc. Acad. Nat. Sci. Philadelphia, 1860 (May), p. 156.

Clemens described the species as follows:

Antennæ luteous. Body and head rather dark brown. Fore wings yellowish-brown, with a rather faint whitish, angulated band at the base. On the discal nervure is a round, black ocellus having a central subvitreous streak, containing a yellow circle, and toward the base of the wing a slender blue crescent. A whitish band crosses the middle of the nervules, with a faint wavy one between it and the hind margin. In the apical interspace is a black spot, with a crimson streak to the tip of the wing. The marginal portion of the wing is whitish, and is tinged on the terminal edge with pale yellowish brown. Hind wings similar in color and ornamentation to the fore wings, the ocelli being somewhat smaller. On the *under surface*, which is similar in hue to the upper, the faint wavy bands of the fore and hind wings are very distinct.

Texas. From the Smithsonian Institution. Capt. Pope's collection.]

[The egg, young larva, cocoon, and pupa of *A. galbina* were described by Henry Edwards in Entomologica Americana, IV (1888) p. 61. The newly hatched larva is black, sparsely covered with long fawn-colored hairs; head very large, glossy.]

AGAPEMA ANONA (Ottolengui).

Plate LIX, figs. 5, 6; LXIII, figs. 9–13.

[*Saturnia anona* OTTOLENGUI, Entom. News., XIV, p. 314.]

[♂. Stalk and branches of antennæ olive green with dark smoky brown feathers; head and legs clothed with rough black-brown hairs; thorax with long, pink-brown hairs overlying shorter blackish hairs; abdomen dorsally clothed with short blackish hairs; mingled laterally and ventrally with coarse pink-brown ones and with anal tuft composed of hairs of a similar color. Primaries blackish (in faded specimens this color turns to deep brown); a white, strongly outcurved antemedial band proceeding from costa near base of wing to the inception of vein Cu_2, thence to inner margin at about one-fourth from base; a slightly waved postmedial white band, from costa before apex to just beyond middle of inner margin; this band may pass entirely beyond the ocellus, or it may touch its outer margin, in which latter case it tends to broaden and flow around the apical portion of the ocellus; in the median space between the two white bands the cubital vein and its branches are more or less broadly outlined in white, in cases where the postmedian band does not touch the ocellus the median branches between ocellus and band are also tinged with white, and at times the anal vein is narrowly outlined with the same color; at the end of the cell the interspace between median and cubital veins is occupied by a large black ocellus, with orange-yellow annulus, the central portion more or less filled with white scaling, and with a blue crescent-shaped line outside the annulus toward base of wing; beyond the postmedian line at apex of wing a more or less distinct black, rather diffuse patch, from the lower portion of which a curved crimson line extends to apex of wing; a very faint waved white subterminal line; terminally the dark area of wing is very distinctly defined by a broad white band forming scallops between the veins on its inner margin; the outer half of this band is heavily shaded with olive brown, the two areas being sharply and evenly defined. Secondaries with the basal two-thirds white, sprinkled broadly and rather heavily along costa with blackish; from this blackish area an indistinct outcurved black subbasal band extends downwards as far as the inception of vein Cu_2; a faint black waved postmedian line, shortly beyond which the subterminal area of wing becomes blackish with a broad terminal border exactly as on primaries; a faint white waved subterminal line may at times be traced through the dark subterminal area; ocellus as on primaries, slightly smaller. Beneath, primaries largely as above; subterminal white line more distinct; other markings fainter and

more diffuse; secondaries with the black costal area much more prominent, extending, except at base of wing, to the median vein; subterminal white line distinct.

♀ antennæ paler than in ♂. Primaries much as in the ♂ sex, except that the veins of median area are not outlined with white; secondaries wholly blackish, except the border with diffuse white outcurved subbasal band and slightly waved white postmedian stripe; terminal border *as in primaries*. Expanse 50–62 mm. Described from a series of fresh bred specimens. Several of Ottolengui's points of distinction between the two species (vide Ent. News., XIV, 314) do not always hold, although useful in many instances. The most evident point of distinction between the ♂ ♂ is that in *galbina* the basal and median areas of primaries are largely white, whilst in *anona* they are blackish with distinct white banding and markings. Attention might also be drawn to the secondaries of *anona* which have the costal portion shaded with dark scales, from which a dark subbasal band arises extending one-half across the wing; in *galbina* neither band nor dark scaling is present. The ♀ ♀, as Ottolengui states, are much more similar than the ♂ ♂; fresh specimens may probably be separated by the difference in the outer border, although this is at times not nearly as marked as he would have us believe, and in faded or worn specimens of small use in separating the species; the diffuse while subbasal band on secondaries of *anona*, giving a general lighter appearance to this portion of the wing appears to be a good point of distinction, our two ♀ ♀ of *galbina* showing no trace of this.—J. McDunnough.]

[Larva on "Grease wood," fide Mr. Morris Chrisman. J. McDunnough, litt. 1912.]

[We have just bred a good series from cocoons sent from the neighborhood of Redington, Ariz.; these emerged from the middle of October until the first week of November, emergence taking place in the early afternoon. I secured two pairings the same evening and found that the ♀ ♀ had deposited their whole batch of eggs by the following morning; these I now have outside and hope they will remain unhatched until spring. Ottolengui's lengthy description of the points of difference from *galbina* do not always hold as we have specimens in which the median band does *not* touch the eye-spot. Judging by the two ♂ ♂ of *galbina* from Texas we possess we should characterize it as a generally much darker local race of this species.—J. McDunnough.]

[Plate LIX, figs. 5, 6, represents a race which may be called *dyari*, from Chihauhua. It is remarkable for having the hind wings of the female pale, with the usual ocellus and single broad dark band.]

AGAPEMA HOMOGENA Dyar.

Plate LIX, figs. 1, 2.

[*Agapema homogena* Dyar, Proc. Ent. Soc. Washington. 1908, p. 82. Mexico and Arizona.]

[The original description is as follows:

A specimen standing under the name *Agapema galbina* in the National Museum collection for the last 14 years was long since recognized as a distinct species, but no mate to it had ever been received. Now a male specimen has been sent by Mr. Roberto Müller from Mexico City, which, while more brightly colored, appears to be certainly the same species. It is accordingly characterized herewith:

Male.—Antennæ very broadly, doubly bipectinated, ocher-yellow. Body clothed with long blackish hair, paler at the tips of the segments, the feet reddish. Fore wings grayish black, finely interspersed with whitish hairs, the veins lined in carneous-ochraceous; inner line angled on the median vein, white, overspread with pink; discal mark ocellate, black-edged and black-centered, containing an orange-ocherous annulus and a blue crescent on its inner side; outer line white, rather broad and straight, with a narrow inner pink edging; outer margin white, shading to clay color on the edge; a white subapical dash edged with crimson below and outwardly. Hind wing similar, the inner line wanting, the base broadly suffused with pink; discal mark with the lumen wholly or nearly occluded; outer line indented slightly on the veins; margin as on fore wings, the wing veins only obscurely pale-lined. Expanse, 65 mm.

Female.—Similar to the male, but the lining of the veins much less distinct, except on vein 7 and the costa; all the colors are somewhat paler than in the male and the pink tint is wholly wanting, but this may be due to age. In consequence the basal space appears darker than the rest of the wing, while on the hind wing the base is whitish. The ocellate discal spots are more widely centered and larger, that of the hind wing having a distinct central lumen. Expanse, 78 mm.

One male, Mexico City, Mexico, March, 1908 (R. Müller); one female, Fly Park, Chiricahua Mountains, Ariz., 10,000 feet, June 9, 1894 (United States Department of Agriculture).

Type.—No. 11871, United States National Museum.]

[AGAPEMA COPAXOIDES Dyar.

Plate LXXVI, fig. 4.

Agapema copaxoides Dyar, Proc. U. S. Nat. Mus., 1912.]

CERANCHIA Butler.

Ceranchia Butler, Ann. and Mag. Nat. Hist. [(5) II], 1878, p. 461.

Nearly allied to *Saturnia,* but antennæ broadly pectinated in both sexes; radial vein emitted in male (but not in female) from fourth subcostal branch, with which it forms a fork, starting from an apparently independent footstalk at upper angle of discoidal cell; wings hyaline.

[The type is *C. apollina* Butler, from Madagascar. All the species cited by Kirby are from Madagascar, except *C.* (?) *mollis* Butler, from Mombasa. *C.* (?) *mollis* becomes the type of *Leucopteryx* Packard.]

LEUCOPTERYX Packard.

[*Leucopteryx* Packard, Journ. N. Y. Entom. Soc., XI (1903), p. 248.]

Imago.—The head is partially concealed by the high overhanging thorax; it is not prominent; the front unusually wide between the eyes. The antennæ are wanting in my specimen. The vestiture of the front short, fine, and wooly.

Palpi not visible, apparently 1-jointed, short, feeble, and drooping. Body rather stout; the vestiture short, the hairs very fine and rather short.

Fore wings short and broad, not falcate; costa straight, a little curved toward the apex, which (though broken off) appears to be rather obtuse and subrectangular; outer edge shorter than the inner and slightly convex. Hind wings rather long, costa not very convex, apex rounded, outer edge full, well rounded, inner edge rather long, extending a little beyond the end of the abdomen.

Venation: Closely similar to that of *Heniocha terpischore;* the first subcostal vein (II_1) arising in the same position and ending just before the apex of the fore wing; the origin of the semiindependent vein (III_3) is the same, and the discocellulars collectively made a slight inward angle; in the hind wing they make a straight line.

Markings: Ground color white and pearl ash gray; no definite lines on the wings of either pair. On the fore wings a moderately large round discal spot, solid in the center except a narrow, clear, linear chink. On the hind wings no complete ocellus, but a subtriangular, dark, opaque spot, with a slight linear chink or fissure.

The type of this genus is *Ceranchia? mollis* Butler, Trans. Ent. Soc. London, 1889, p. 391, Pl. 12, fig. 5. I have had the opportunity, through the kindness of Dr. G. H. Dyar, of examining a female from Tana River, East Africa, north of Mombasa, collected by the Chandler Expedition for the United States National Museum.

Geographical distribution.—Ethiopian realm, eastern Africa, Mombasa and Tana River north of Mombasa in British East Africa.

This genus by its venation closely approaches the African species referred to *Heniocha* (*H. terpsichore*), but differs from any of that group in the shorter, wider fore wings, and the absence of any transverse lines. The type of Mr. Butler's description is in the British Museum.

LEUCOPTERYX MOLLIS (Butler).

Ceranchia (?) *mollis* Butler, Trans. Ent. Soc. London, 1889, p. 391, Pl. 12, fig. 5.

Imago.—One ♀. Ground color of body and wings snow-white. Head and legs sable brown; thorax snow-white; abdomen pale slate clay color.

Fore wings on the basal third to half pale sable clay, dusted with white toward the costa. Middle of wing including the discal spot snow-white shading toward the outer edge into pale sable, the line of division between the clay and white very marked. Discal spot (4 by 4 mm.) consisting of a large central black roundish spot, encircled with white, and an outer reddish ring, in the middle a linear vitreous chink or crack.

Hind wings snow white, pale sable hue on the outer edge. The discal spot one-half as large as that on the fore wing, subtriangular, a little wider than long (2 by 2 mm.).

Under side of the fore wings with the discal spot square, with no ring, but faintly edged with white. Hind wings as above; no line beneath, but the whole wing pale clay-white toward the inner edge; toward the costa and outer edge slate.

Expanse of wings, ♀ 80 mm.
Length of fore wings, ♀ 40 mm.
Breadth of fore wings, ♀ 22 mm.
Length of hind wing, ♀ 30 mm.
Breadth of hind wing, ♀ 22 mm.

Geographical distribution.—Tana River, East Africa, south of Mombasa (Chandler Expedition, 1892–93, United States National Museum); Mombasa(British Museum).

HENIOCHA Huebner.

Heniocha Huebner, Verzeichniss bek. Schmett., p. 157, 1822?.
Saturnia Moore, Trans. Ent. Soc. London, (3) II, p. 424, 1865.
Saturnia Maassen and Weymer, Beiträge z. Schmett., 1872.
Heniocha Butler, Annals and Mag. Nat. Hist., (4) XX, p. 462, 1877.
Saturnia Westwood, Oates, Matebele Land, p. 357, 1881.
Heniocha Aurivillius, Oefv. Vet. Akad. Förh., XXXVI (7), p. 50, 1879.
Heniocha Rogenhofer, Verh. Zool. Bot. Ses. Wien, XLI, p. 565, 1891.
Heniocha Kirby, Syn. Cat. Lep. Het., I, p. 769, 1892.
Heniocha Rothschild, Novitates Zool., II, p. 49, 1895.
[According to Kirby *H. apollonia* is the type of the genus.]

LARVA.

Aurivillius, Arkiv. Zool., II (1905), p. 34, pl. 2, fig. 1 (*H. terpsichore*).

Imago.— ♂, ♀. Head moderately prominent; the front moderately wide, slightly narrowing toward the labial region; vestiture moderately close. Antennæ of ♀ bipectinate, distal parts about one-half as long as the basal, the latter a little thickened toward the end, very slightly ciliated with minute very short filaments; consisting of about 32 joints, the last eight without pectinations. Palpi short, porrect, not reaching the front. No vestiges of maxillæ in the undenuded example.

Fore wings with the costa straight to near the apex, where it is slightly curved, the apex moderately rounded, the outer edge moderately full, not falcate. Hind wings with the outer edge full and convex.

Venation: Differs decidedly from *Usta* in vein II_1 of fore wing, arising much farther in toward the base of the wing, so that the space between it and the common stalk of vein II_2, II_3, and II_4 is much wider; on hind wings the discal vein arises farther from the origin of vein IV_1 (second median), the discocellular veins, as in *Usta*, making a decided angle or a regular curve.

Coloration: Ground color, white, with four brown bands on the fore wings and three on the hind wings; a large complete ocellus usually on each wing, those of the fore wings much larger than those on the hind wings in the type species (*H. apollonia*). A subapical oval spot at the costal end of the extradiscal line and a reddish brown spot at the end of the submarginal line; two of the lines or shades situated within the ocellus of the fore wing.

Geographical distribution.—This genus is confined to the Ethiopian realm, most of the species being southeast African.

Rothschild, in Nov. Zoologicæ, thus arranges the species:

1. *H. apollonia* (Cram).
   ab. *flavida* (Butler).
2. *H. bioculata* Auriv. [?=*marnois*.]
3. *H. marnois* (Rogenh.) [Lake Victoria Nyanza.]
4. *H. dryops* (Maass. and Weym.).
5. *H. terpischore* (Maass. and Weym.).

H. terpsichorina (Westw.) is *Usta wallengreni* (Felder).

H. pyretorum is referred to *Saturnia* [but has since been made the type of a new genus (*Eriogyna*) by Jordan. Dr. Packard actually designated *H. pyretorum* as the type of a new genus, without suggesting a name, in a brief memorandum].

[*Heniocha lindti* Grünberg (1910), from southwest Africa, has recently been added to the genus.]

HENIOCHA APOLLONIA (Cramer).

(Fig. 17.)

Plate XXXVIII, fig. 5.

Phalaena Attacus apollonia Cramer, Papillons Exotiques, III, p. 97, Pl. CCL, A. 1782.
Bombyx apollonia Olivier, Encycl. Méth., Ins., V, 31, 28, Pl. 70, fig. 4, ?1789.
Heniocha apollonia Hübner, Verz. bek. Schmett., p. 157, ?1822.
"*Heniocha apollonia* Angas, Pl. Lep. Zoolu Country," ?1847.
Saturnia apollonia Westwood, Proc. Zool. Soc. London, 1849, p. 47.
Saturnia apollonia Walker, Cat. Lep. Het. Brit. Mus., VI, p. 1272, 1855.
Heniocha apollonia Kirby, Syn. Cat. Lep. Het. I, p. 771, 1892.
Heniocha apollonia Rothschild, Novitates Zoologicæ, II, p. 49, 1895.

Imago.—One ♀, one ♂. Head and body dull cream white. Fore wings white as a ground color; base of the wing brown, with ochreous and white sclaes extending from the base along the costa, forming a wide costal shade. Three lines beyond the base, of which the basal one forms an oblique band in the discal cell near the discal spot and is characteristic of the species. Two extradiscal wavy lines brown, edged within with ochreous; outer edge of the wing, including the margin and fringe, pale sable brown. Discal spot or ocellus large, round, black, not clear, but the scales have clear spaces between them; the balck center is inclosed by a linear white circle, then a black brown circle edged externally with dull ochreous; 8 by 7 mm.

Hind wings white, with two broad lines beyond the discal spot as on the fore wings. Discal ocellus smaller than on the fore wings, but without any ochreous ring; 6 by 6 mm.

Expanse of the forewings, ♂, 100 mm.; ♀ 95 mm.
Length of a fore wing, ♂, 45 mm.; ♀ 45 mm.
Breadth of a fore wing, ♂, 23 mm.; ♀ 24 mm.
Length of a hind wing, ♂, 31 mm.; ♀ 32 mm.
Breadth of a hind wing, ♂, 24 mm.; ♀ 25 mm.

Geographical distribution.—Cape of Good Hope (Layard; Mus. Comp. Zool. Cambridge, Mass.; British Museum), Port Natal (British Museum).

HENIOCHA TERPSICHORE (Maass. and Weymer).

[*Saturnia* (?) *terpsichore* Maassen and Weymer, Beitr. Schmett., V (1886), figs. 113, 114.]

Larva.—Last stage: Length, 60 mm. Body cylindrical. Head small, only slightly more than one-half as wide as the prothoracic segment; surface smooth, with groups of from one to five or six microscopic granulations; blue black, shining, sending off steel-blue reflections. Prothoracic plate smooth, shining, with slight vestiges of two tubercles on the front edge of each side of the median line low down, the lower one (infraspiracular) directly over the base of the legs, the larger of the two, it is broad and flat, bearing five small tubercles, but no setæ. The two hinder thoracic segments each with eight tubercles, those of the dorsal and supraspiracular series about twice as high as thick, square at the end, being more or less truncated, and bearing six stump-like tubercles, which look like the base of a broken seta. (I am not sure whether the setæ are really broken off or wanting.) Those of the dorsal and subspiracular series of the abdominal segments are not quite so large and high and are more conical than the thoracic ones.

On the tergum of the eight abdominal segment are *two separate dorsal tubercles;* they are slightly larger and higher than those on the abdominal segments in front and are square at the end; they are quite wide apart; those of the ninth segment are of the same size, but much farther apart.

FIG. 17.—*Heniocha apollonia* (Cramer). [Type of genus.] Cape of Good Hope (Layard); Museum of Comparative Zoology. (Dr. Packard has added a pencil note: "Very near *Heniocha dyops*.")

Suranal plate regularly triangular, the surface rather rough, the edges with minute conical tubercles and two small ones, one on each side of the middle of the upper surface. Anal legs large, triangular, and with scattered stiff setæ arising from the surface. Skin smooth, with scattered short microscopic stiff setæ. Pale yellow (in formalin), with broad irregular dark rich steel-blue bands, one on the two hinder thoracic segments, two on each abdominal one, the two bands becoming confluent on the tergum. Prothoracic segment and tenth abdominal, including the suranal plate and anal legs, steel-blue, thoracic and abdominal legs steel-blue.

Young larva, when 24 mm. in length (third stage?).

It is almost exactly in shape and style of coloration as described under the last stage, but the tubercles are a little larger in proportion to the body than in the final stage.

In this stage the conical square-tipped tubercles on the main tubercles look like the stumps of setæ; they are either broken off or are not developed. It is a singular case of the total reduction of the setæ, showing that the genus *Heniocha* is a widely divergent member of the Saturniinæ.

Young larva in a succeeding stage, length 28 mm.; the head is considerably larger than in the previous stage, otherwise the caterpillar does not differ from that of the preceding stage.

This must be a very conspicuous larva. It is either probably poisonous or bad tasting, its bright conspicuous colors being warning hues.

It can not be a Ceratocampid, since there are six tubercles on the eighth abdominal segment, the two tergal ones being widely separate on both the eighth and ninth segments. This feature would indicate that from its larval characters *Heniocha* belongs with the Saturniinæ.

[ERIOGYNA Jordan.]

[*Eriogyna* Jordan, Seitz, Macrolepidop. World, Division 1, p. 221.]

ERIOGYNA PYRETORUM (Westwood).

Plate XXXVIII, fig. 4; XCVIII, fig. 2.

[*Geographical distribution.*—"From the Amur to Hainan, Tonkin and north India" (Jordan). Subspecies *cognata* Jordan in East China, and *luctifera* Jordan in West China.]

LOEPA (Moore).

[*Loepa* Moore, Cat. Lep. Ins. E. I. House, II (1859), p. 399.]

[Type *L. katinka* (Westw.).]

[Rothschild, Nov. Zool., 1895, recognized three species. Additions have since (1911–12) been made by Jordan.

(1) *L. katinka* (Westw.).
ab. *sikkima* Moore. (Jordan now regards this as a valid species.)
subsp. *megacore* Jordan (Sumatra).
(2) *L. miranda* Moore.
(3) *L. damartis* Jordan. (Central and western China.)
(4) *L. oberthuri* (Leech).
(This has been referred to *Saturnia*.)
syn. *dognini* Sonth. (♀).
(5) *L. anthera* Jordan (Tonkin and Assam.).]

LOEPA KATINKA (Westwood).

Plate XXX, figs. 6, 7; XXXVIII, fig. 6; CV, figs. a–d.

[The larva of *L. sikkima* Moore is known. Cocoon dense, pointed at both ends. Food plants, *Cissus* and *Leea*.]

COPAXA (Walker).[1]

[*Copaxa* Walker, Cat Lep. Het. Brit. Mus., V (1855), p. 1235.]
[Type according to Kirby, *C. decrescens* Walker.]

Notes on *Copaxa trötschi* Druce (Biol. Centr.-Amer.); fore wing very falcate; three lines, basal widely dislocated; extradiscal straight, broad, dark, bent outward toward apex; a *median line*, scalloped and *ending on the ocellus*, no such line in hind wing, but latter has a basal and two distinct extradiscal lines. Ocelli more or less *pear-shaped*, being produced backwards, i. e., toward the median vein, each with a pear-shaped clear space.

Is this a primitive or specialized genus?

[Venation: Various species have III_{2-3} joined to end. *C. disjuncta* has III_2 and III_3 separate.]

COPAXA MULTIFENESTRATA (H. -Schäff).

Plate XXX, fig. 5; XXXIX, fig. 1.

COPAXA CHAPATA (Westwood).

Plate XXXIX, fig. 2.

COPAXA DENDA Druce.

Plate XXXIX, fig. 3.

COPAXA DECRESCENS Walker.

Plate XXXIX, fig. 4.

COPAXA DISJUNCTA.

Plate XXXIX, fig. 5.

COPAXA CANELLA Walker.

Brazil; three ♂, one ♀ in Paris Museum. Fawn color; ocelli alike on each wing; three bands on both wings; female antennæ well pectinated. One male from Mexico is deep orange red, with the ocelli on fore wing larger than on hind wing.

[COPAXA (?) LAVANDERA (Westwood).]

Plate CV, figs. e–f.

[At the Paris Museum Dr. Packard examined an example from Mexico (the species name credited to Boisduval) and noted "Very near *Saturnia*."]

[SATURNIODES Jordan, 1911.

Based on *S. medea* (*Saturnia medea* Maass.) from Ecuador, of which Jordan describes three subspecies from Peru, *carina, charila,* and *miles;* the last from an altitude of 12,000 feet. Dr. Dyar adds to the genus *S. ockendeni* (Druce, Ann. Mag. Nat. Hist., (7) XVII, p. 411, 1906). In the United States National Museum is a male of this genus from the mountains of Peru; Dr. Dyar notes that it looks a good deal like *Agapema*.].

[OPODIPHTHERA Wallengren, 1859.[2]

Plate CXII, figs. *a, b*.

A genus of the Australian region. *O. astrophela* (Walker, 1855) and *O. fervida* Jordan, 1910, are from Australia. *O. papuana* Rothschild, 1904, *O. albicera* (Roth. and Jord., 1907),

[1] [*Copaxa marona* Schaus, of which I examined the type in the U. S. National Museum, has fasciculate antennæ, and can not belong to *Copaxa*. It is a most singular species; a sort of purplish red, with dark lines crossing the wings, part of them on the veins, part modified transverse bands, but all narrow and similar. No discal ocelli or spots. A chalky-white subapical mark on primaries.]

[2] [Wallengren's original description of *Opodiphthera* (Öfv. Kgl. Akad. for 1858, published 1859), kindly supplied by Mr. Watson, is as follows: "Antennæ utriusque sexus pennatæ, maris latiores; pecten utrinque duplicatum, radiis æqualibus. Palpi brevissimi, hirsuti, articulis indistinctis. Caput retractum, in thorace intrusum. Frons hirsuta, per medium perpendiculariter haud canaliculata. Thorax antice declivus, supra depressus, dense villosus scapulis brevissimis. Abdomen villosum, crassum. Pedes usque as apicem tarsorum dense hirsuti, præsertim apud marem. Villositas tibiarum et femorum longissima. Alarum forma fere ut in genere præcedente, sed apex anticarum nunquam falcatus, et alæ magis tenues, præsertim in femina fere subdiaphanæ. Angulus anticus al. posticarum fere rotundatus. Costæ alarum omnino ut in Saturnia, sed cellulæ in partes 3 per plicam furcatam divisæ. Fam. Saturnides. Species typica: *O. varicolor* n. sp., e Nova Hollandia." *O. varicolor* is a synonym of *O. astrophela*.]

O. venusta Roth. and Jord., 1907, and *O. inversa* Rothschild, 1896, are from New Guinea. Good figures of three species are given in Nov. Zool., 1908, Plate IX. Jordan (1908) calls the genus *Opodiphthera*, but Kirby writes *Opodiphtera*.]

TAGOROPSIS Felder.

Drexta Walker, Cat. Lep. Het. Brit. Mus., XXXII, p. 373, 1865.
Tagoropsis Felder, Reise d. Novara, Lep., IV, Taf. 88, fig. 2, 1874.
Tagoropsis Kirby, Syn. Cat. Lep. Het., I, p. 755, 1892.
Tagoropsis Sonthonnax, Annales Lab. d'Etudes de la Soie, X, p. 69, 1900.

Imago.— ♂. Head moderately prominent; front moderately wide, not much wider than one of the eyes; vestiture moderately long, though not shaggy, the hairs in front nearly concealing the small short feeble drooping palpi, which can only with difficulty be detected with a lens. Antennæ not very long, subplumose, with about 36 joints, those toward the base shorter than broad, those toward the end about twice as long as thick; but a single pair of pectinations to a joint; they are very long and slender, overlapping each other at the end; the distal pectinations are atrophied and represented by minute scales. Body moderately stout; the abdomen only reaching to the outer third of the hind wings.

Fore wings decidedly falcate; costa straight on the basal two-thirds, toward the apex much curved; the apex decidedly produced, though somewhat blunt at the tip; outer edge equal to the inner in length, well excavated behind the apex; inner angle rounded.

Hind wings with the costa not very full; apex not much rounded; the outer edge moderately full, the inner angle squarish.

Venation: Near that of *Copaxa* and *Syntherata* (*S. insignis*), but nearest to *Caligula;* from the latter it differs; three branches of vein II are present and much as in *C. helena*, the origins of veins III_2 and III_3 and of the anterior discal veins are all at the same point, vein III_3 showing no signs of detachment from its stalk, as it does in *Caligula* and *Syntherata;* the discocellulars form a slightly incurved line; in the hind wings vein III_2 is much less detached and the discocellulars form a decided oblique line, while the origin of II is nearer the middle of the discal cell than in *Syntherata*.

Legs rather large and long, the tarsi well developed. Coloration: Ground shade bright lemon-yellow, with reddish brown fine lines and a very small oval ocellus on the fore wings, with a small narrow clear central space. Hind wings with no ocellus. The same markings on the under side of wings of both pairs. This genus by its venation comes nearest to *Caligula japonica* and especially *C. helena*, and is also closely allied to *Copaxa* and *Syntherata*.

Geographical distribution.—The species spread over western and especially southern Africa, and thence to Delagoa Bay, Victoria Nyanza, and four species are reported as inhabiting Madagascar.

TAGOROPSIS FLAVINATA (Walker).

Plate XXX, fig. 4; XLI, fig. 2.

Drexta flavinata Walker, Cat. Lep. Het. Brit. Mus., XXXII, p. 373, 1865.
Tagoropsis natalensis Felder, Reise d. Novara, Zool., Th. Bd. II, Abth. 2, Tab. LXXXVIII, fig. 2, 1874.
Tagoropsis natalensis Maassen and Weymer, Beiträge Schmett., IV, figs. 57 ♂, 58 ♀, 1881.
Tagoropsis flavinata Kirby, Syn. Cat. Lep. Het., I, p. 755, 1892.
[This is the type of the genus, according to Kirby.]

Imago.—One ♂, one ♀. Body and wings above and beneath clear lemon-yellow, the female more ochreous. Head, front of collar and breast reddish pink, legs pink and yellow, the longer hairs yellow.

Fore wings with an irregular zigzag basal brown line, broken and spreading widely on the costa, and dislocated on the median vein. Costa reddish brown to base of the wing. An eight-scalloped faint narrow extradiscal line nearly touching the ocellus; a third narrow line passing straight from the outer third of the inner edge to about the outer seventh of the costal edge, being situated about halfway between the ocellus and outer edge. Ocellus small, oval, forming a simple brown ring with a few scattered white scales inclosing a minute oval-lanceolate clear or (on the left wing) white spot.

Hind wings with a scalloped basal, and a faintly marked extradiscal line, while halfway between the extradiscal line and the outer edge is a series of about five little obscure brown spots which are larger and heavier in the female.

Under side as above, but the ocelli less distinct.

Expanse of the fore wings, ♂ 80–85 mm.
Length of a fore wing, ♂ 45 mm.
Breadth of a fore wing, ♂ 25 mm.
Length of a hind wing, ♂ 32 mm.
Breadth of a hind wing, ♂ 25 mm.
Discal spots of fore wings, ♂ 3 × 2 mm.

Geographical distribution.—Natal (J. Queckett); Zanzibar (collection of W. L. Abbott, United States National Museum).

Larva.—Length 50–52 mm. Head rather small, smooth, unarmed, considerably narrower than the prothoracic segment, and of the same width as the prothoracic plate; pale chestnut or reddish honey-yellow. Prothoracic plate armed with four tubercles, but the two on each side of the median line are nearly fused at the base. From the inner or median tubercles arise two, and from the outer four conical warts or tuberculets, giving rise to long slender setæ, and on the posterior edge of the plate are two minute setiferous tubercles, one on each side of the median line. Over the surface of this plate, as well as the rest of the body, are scattered short minute clavate setæ. The prothoracic tubercles (one on each side of the body) of the supraspiracular series are distinct and bear seven conical setiferous secondary warts; those of the infraspiracular series being situated directly over the base of the legs.

The dorsal thoracic and abdominal tubercles are large, high, and much alike. Those of the second, third thoracic, and first to seventh abdominal segments are alike in size, height, and shape; there are eight tubercles on each thoracic, and six on each abdominal segment. Those of the three dorsal rows (supraspiracular and subdorsal) are nearly alike in size, those of the supraspiracular row a little smaller than those above. Of the submedian dorsal row (one on each side of the median line) those on the second thoracic segment are fused together at the base; those of the third thoracic segment are less so, a ridge connecting them; those of the first abdominal segment are entirely separate. Each tubercle is stout, cylindrical, about three times as long as thick and bearing four to five conical warts (one in the center), each of which give rise to a long stout seta. The median abdominal tubercles differ from those of the thoracic segments in the crown, being more oblique, less flat, and regular. On the abdominal segments the infraspiracular tubercles are reduced, becoming small, low, flattened, and bearing from two to four setiferous warts or tuberculets.

The median tubercle on eighth abdominal segment is about twice the size of those on each side and is forked or divided nearly halfway down, showing the late fusion of the originally two separate dorsal tubercles, which will probably in stage I be found to be entirely separate; each fork is capped with three setiferous tubercles. On the ninth abdominal segment are four dorsal tubercles (two supraspiracular), the two on each side fused at the base.

Suranal plate triangular, a little broader than long, the end conical, stout, solid; the surface with a pair of low double-headed stout tubercles, with two simple and several smaller ones on each side, while the edge is rough with setiferous tubercles, both coarse and fine. Anal legs of moderate size, the lateral subtriangular thickened area with setiferous tubercles around the edge; the setæ long, bristlelike. Thoracic legs reddish honey-yellow; abdominal ones a little paler, with a number of setiferous warts at the base.

The body is striped somewhat like a *Datana* larva from the first thoracic to the ninth abdominal segment with coarse black-brown and pale yellowish green (in formalin) stripes. A black median dorsal stripe, and also six on each side and underneath, except on the leg-bearing segments; the dark stripes broken up into irregular spots along the base of the abdominal but not of the thoracic legs; thus the black lines are more broken on the abdominal than on the thoracic segments, the process of *formation of spots beginning from behind forward, as in larvæ of other lepidopterous groups.*

This is a very conspicuous caterpillar; and like most of the African species of Bunaeinae, those which are very spiny are also very showily ornamented, with black, black and white, or red, or black and yellow, or red and brown marks. Like *Vanessa* larvæ, being protected by their spines, they are decked in bright, conspicuous colors.

The larva above described is from Natal, kindly loaned by Lieut. Col. J. M. Fawcett.

SYNTHERATA Maassen.

[*Syntherata* Maassen, Beitr. Schmett., III (1873), figs. 42, 43.]

[*S. weymeri* Maassen is the type.]

[Rothschild, Nov. Zool., II, 1895, thus arranges the species:]

(1) *S. janetta* (White). [Australia.]
ab. *melvilla* (Westw.). [Melville I.]
ab. *disjuncta* (Walk.). Amboina and German New Guinea.
ab. *weymeri* (Maass.). [Australia.]
(2) *S. godeffroyi* Butler. [New Britain.]
(3) *S. loepoides* (Butler). Java, and Mount Kina Balu, northern Borneo.

[Sonthonnax (1900) has described a species from Madagascar as *S. madagascariensis*.]

SYNTHERATA INSIGNIS (Walker).

Plate XLI, fig. 3.

RHODIA Moore. [RHODINIA Staudinger, 1892.]

[*Rhodia* Moore, Proc. Zool. Soc. Lond., 1872, p. 578; nom. praeocc. (Bell, 1835).]

[Rothschild, Nov. Zool., II (1895), p. 45, lists the species as follows:]

1. *R. newara* Moore. [Nepal.]
2. *R. fugax* Butler. [Japan.]
subsp. *diana* (Oberth.). [Manchuria.]
3. *R. jankowskii* (Oberth.). [Askold.]
4. *R. davidi* (Oberth.). [Thibet.]

[*R. thespis, royi* and *olivacea* are referred to *Salassa*.]

[Venation: *R. newara* (type of genus) has III_1 separate at end, $III_2 +_3$ fused. *R. fugax* (both sexes) has III_2 widely separated at end from III_3.]

RHODIA FUGAX Butler.

Plate XXVIII, fig. 6; XXIX; XXX, figs. 1, 2; XL, figs. 2, 3; CII, figs. a–d.

Rhodia fugax Butler, Annals. and Mag. Nat. Hist., (4) XX, p. 480, 1877. Illustrations of Lep. Het. Brit. Mus., II, p. 17, Pl. XXVI, fig. 1, 1878.
[*Rhodinia fugax* (Butler).]

"♂, allied to the Indian *R. newara*, but much smaller, the primaries less falcate; the transverse bands darker, grayer, more dentated; the hyaline spots of primaries much larger, those of secondaries much smaller, the rosy tints replaced by rusty reddish, which also suffuses the greater part of the external area of the secondaries; antennæ much darker. Expanse of wings 4 inches, 3–4 lines. Yokohama, Jonas." (Butler, Illustr.)

The eggs, received from Japan, were hatched April 27, and the larvæ described on the 28th. It feeds on the poplar and dwarf willow.

Larva.—Stage I: Length 6 mm. Head large, wider than the body, with long scattered hairs; brown-black with a transverse whitish patch on the clypeus-anterior, while the base of the antennæ is of the same color, so that across the front of the head extends a broken whitish inconspicuous line. The body, as usual in freshly hatched Saturnian larvæ before the larva has taken food, tapers to the end.

The dorsal tubercles are distinct, a little longer (or higher) than thick, those on the thoracic segments larger than the abdominal ones; those on the prothoracic segment about half as large as those on the second thoracic segment, which are very slightly larger and longer than those

on the third thoracic segment. The prothoracic dorsal tubercles each bear four curved setæ, while the second and third thoracic tubercles each carry six setæ. The abdominal tubercles are nearly as long as the thoracic ones, but much slenderer, and they are rather high, contracting in diameter in the middle; they each bear two or three long curved black stiff bristles, and two minute ones, the long ones being curved backwards, and before the larva has begun to feed they are longer than the body is thick, so that it appears to be rather thickly clothed with fine black bristles.

The single median dorsal tubercle on the eighth abdominal segment is a third thicker than the others in front, bearing three long black setæ on each side.

The two dorsal tubercles on the ninth abdominal segment are quite large, larger than those on abdominal segments 1–7. Two dorsal tubercles arise from near the middle on each side of the suranal plate; they are only a third smaller than those on the ninth segment; around the edge of the suranal plate arise long grayish stiff straight hairs, and the bristles on each lateral tubercle are grayish and directed downward.

The body is dull straw-yellow on the sides and black above. The wide black dorsal band is irregular in width, varying at the end of the stage.

It gives off on each side behind the middle a straight black rectangular line forming a black half-ring extending down to near the spiracles; the hinder edge of each segment is black. The color variations of the larva in this stage are marked; in the most extreme the entire upper part of the body is black below the spiracles, the black pigment extending down from the main mass to the infraspiracular tubercles, the under side only of the body being yellow. There is low down on the side of the body a narrow worn somewhat broken black line, situated below the infraspiracular tubercles. Spiracles small, inconspicuous, black. Thoracic legs black; abdominanl legs in general yellow, when freshly hatched black, the planta slightly purplish livid. In this stage the larva is very pretty and interesting, but with the true Saturnian shape of body and tubercles. They molted May 24 or 25.

Stage II: Length 12 mm.; toward end of stage 18 mm. Now very different from stage I. The body is pale straw-yellow, and no black on it in my examples (while one of those reared by Mr. Joutel is black on the sides and on the first, third thoracic, and eighth abdominal segments, and he found that there are all stages from the wholly yellow to the dark form).

The head is smooth, pale-green, black behind the eyes, the black extending up toward the back of the vertex; it is nearly as wide as the first thoracic segment, which is considerably narrower than the two following. The tubercles are now more prominent and are green and pale turquoise-blue. The four dorsal ones on the first thoracic segment are well developed and higher than before, the two middle ones nearly a quarter larger than the outer ones, each bearing six stiff straight black setæ. The spiracular one is pale turquoise-blue, as all the others of this series to the end of the body. The two dorsal tubercles on the second and third thoracic segments considerably (about one-sixth) larger than those on the abdominal segments and those on the third thoracic considerably larger than those on the second segment; they each bear eight black stiff setæ, seven on the crown with an eighth in the center; these are yellowish at base, beyond turquoise-blue; in the examples I bred the tubercles on the second thoracic segment were green. The setæ on the thoracic tubercles are not more than a quarter larger than the tubercle itself. All the dorsal abdominal tubercles are green (or yellowish green, Joutel), bearing each four black stiff and straight setæ, one of them being usually small; the longest setæ are about one-third longer than the tubercle itself. The dorso-median tubercle on the eighth abdominal segment, unlike all the other abdominal ones, is turquoise-blue; it is fully twice as thick as those on the seventh segment. It does not show its double origin as there is a central seta, and one behind it on the median line, with three on each side of the two; they are not arranged on each side of the median line.

On the side low down are two or three minute black dots below each of the turquoise-blue tubercles of the lowest series.

Suranal plate and its tubercles pale straw-yellow, concolorous with the rest of the body, with a large black roundish spot in the center. In those reared by Mr. Joutel, the two tubercles on this plate are turquoise-blue. Spiracles black, fairly conspicuous. Anal legs green, centered

on the outside by a rather large and conspicuous black spot; the midabdominal legs are green or yellowish green; thoracic legs black.

On June 2 the larva had become 18 mm. in length, otherwise it did not differ from its appearance directly after hatching.

Mr. Joutel's figures illustrate the wide colorational differences exhibited in the same brood of caterpillars. Some represent an entirely yellow individual, except the 11 turquoise dorsal tubercles, and those of the infraspiracular row; and the black lateral line, which is wanting in some of his specimens and mine. He found all variations between these and the very dark larva. In the second stage of the larva the body and tubercles are black, with the exception of the yellow dorsal portion of the second thoracic and abdominal segments 1–7, and the under side of the body, including the midabdominal legs. He tells me that other specimens have as much black pigment on the body, but that the dorsal tubercles on the second and third thoracic and eighth abdominal segments are as blue as in the light-colored caterpillars.

The larva I had in Providence molted for the second time about June 4 or 5.

Stage III: Length 20 mm. The head is now wholly pea-green. The two median prothoracic, and the two dorsal tubercles on the third thoracic segment, and those of the lateral row are turquoise-blue, but the two dorsal tubercles on the second thoracic segment are greenish. The two third thoracic dorsal tubercles are thicker than those on the second thoracic segment, and about twice as thick as those on the first abdominal segment. The medio-dorsal tubercle on the eighth abdominal segment is much thicker than those near it. The proportionate size of all the dorsal tubercles is as in the previous stage. Spiracles pale brown, not conspicuous.

The black dots low down below the lateral ridge are now nearly obsolete.

Anal legs with no external black spots, and entirely green. The thoracic legs green, with a few black spots.

Mr. Joutel, who had more larvæ under inspection than I, says, "All the larvæ are gradually losing the black pigment; the dark ones have only the base of the dorsal tubercles on the third thoracic and eighth abdominal segments black, with the tips blue; also the lower half of the face is black."

It was found to have molted for the third time June 23.

Stage IV: Length 23 mm. (when underfed)–42 mm. The body is now thicker at the third thoracic segment, and in fact somewhat so throughout, while the tubercles are smaller, and all but those on the back of the third thoracic and eighth abdominal segments are decidedly reduced in size. *The skin is now covered with minute rounded warts or granulations.* The head and body are pale greenish straw-yellow (more yellow than green). The tubercles are of the same hue as in stage III. The six tubercles on the front edge of the first thoracic segment are turquoise-blue.

The two dorsal ones on the third thoracic segment are turquoise-blue. The medio-dorsal one on the eighth abdominal segment, and the four on the side of the ninth segment are turquoise-blue, but the two dorsal ones are yellowish, of the same hue as the skin. The lateral series of tubercles are turquoise-blue, as before. On all the tubercles the setæ are black, and shorter than the tubercles themselves are high.

The two dorsal tubercles on the front edge of the first or prothoracic segment are as large as those on the second thoracic segment, *while those on the third thoracic segment are nearly twice as high as thick,* also slightly smaller than in stage III. Each bears six black setæ, and an odd seventh bristle in the center. The setæ are not quite so long as the tubercles are thick.

The dorsal tubercles on abdominal segments 1–7 are now small, slender, scarcely half as high as the two on the third thoracic segment, and evidently undergoing reduction; each bears three setæ of unequal length, two of which are short, and one generally longer, though they vary in length, the longest one being about as long as the tubercle is high. There are six setæ on the medio-dorsal tubercle of the eighth abdominal segment.

Suranal plate with a rather stout turquoise-blue tubercle on each side near the middle, each bearing seven short black setæ; end of the plate armed with five small setiferous tubercles, and an irregular row of black setæ on the edge of the anal legs.

The tubercles of the supraspiracular row are minute, yellowish, and not quite twice as long as thick.

In the few reared by Mr. Joutel the larvæ were all alike, no matter what their color was in the previous stages.

Stage V, and last: Unfortunately my single larva died before assuming its final stage of growth, and I shall have to depend on Mr. Joutel's drawing for the following description. Up to this stage the caterpillar was in all its stages a remarkably striking and exquisitely beautiful one, especially in stages III and IV, where the tubercles were of such a soft and delicate turquoise-blue, contrasting so markedly with the yellow or green hues of the body.

Length, when at rest, head down, 63 mm.; when extended in the act of walking, 78 mm. The body is now thick and fleshy, destitute of tubercles with the exception of the two medio-dorsal ones on the third thoracic segment, and the medio-dorsal one on the eighth abdominal segment, otherwise the body is entirely unarmed, with apparently no traces of the tubercles present in the previous stages. The tubercles on the third thoracic segments are (united into one), stout conical, nearly twice as high as thick at the base, and with a conspicuous dark spot in front. When at rest, head down, this horn projects up in a very conspicuous way. The posterior tubercle (medio-dorsal) is small, low, button-like, not conspicuous; on neither of the tubercles are there any setæ.

The body is now greenish yellow, with the sutures bathed with yellow. The lateral ridge is also yellowish, and along this ridge is a series of small blackish spots, one to each thoracic and abdominal segment, there being one on the side of the suranal plate. The head, all the legs, both thoracic and abdominal legs, and the under side of the body are pea-green.

Such differences between the last and the preceding stages as are seen in this caterpillar are very unusual. It is evident that the tubercles and bristles were undergoing reduction in the fourth stage, but one was hardly prepared for the loss, without apparent vestiges, in the last ecdysis, of all except the dorsal ones on two of the segments. The cause, if it could ever be explained, would be most interesting.

This case reminds us of a member of the same family, *Rothschildia betis*, but in that form all the tubercles are atrophied, and the change from the penultimate to the last is otherwise probably slight. A more striking resemblance is that to the larva of *Cercophana frauenfeldi* of Chili, of which there is a colored drawing in the British Museum. In this case the third thoracic segment is prolonged into a long curved fleshy horn which projects over the head when the latter is retracted. It has no tubercles, and a yellowish stripe extends from the tip of the horn along the side of the body to the end of the acutely prolonged suranal plate.

Its resemblance to the last fourth stage of *Aglia tau* should also be noticed, though the latter at its final molt discards every trace of the armature of its earlier stages. This larva has what Poulton believes to be a terrifying spot on the side of the first abdominal segment. The question arises whether the spot on the front of the thoracic tubercles of *Rhodia fugax* is of this psychological nature, and also whether the dark patch on the front of the body under the horn of *Cercophana* is deterrent to other animals. All three of these larvæ have a conspicuous yellowish or (on *Aglia*) reddish lateral stripe.

Sound produced by the larva.—Mr. Joutel informs me that this larva in its last stage "makes a squeaking noise by moving its head up and down on the prothorax."

RHODIA NEWARA Moore. [RHODINIA NEWARA].

Plates XXX, fig. 3; XL, fig. 1; CII, fig. e.

RHODIA JANKOWSKII (Oberth.). [RHODINIA JANKOWSKII].

One ♂ (Paris Museum). A remarkable form, with clear ochreous yellow [subcircular, somewhat reniform] spaces on fore and hind wings; bands nearly obsolete.

[PARARHODIA n. n.]

[*Eurhodia* ROTHSCHILD 1905; nom praeocc. (D'Arch. Haime, 1853). New Guinea].

[Type, *Pararhodia gyra* (*Eurhodia gyra* ROTHS.)· also includes *P. meeki* (*Eurhodia meeki* Jordan, 1908).]

RINACA Walker.

[*Rinaca* Walker, Cat. Lep. Het. Brit. Mus., VI (1855), p. 1274.]
[Type, *R. zuleika* (Hope).]

[Rothschild, Nov. Zool., II, 1895, thus classifies the species:]

(1) *R. zuleika* (Hope).

(2) *R. thibeta* (Westw.). [syn. *extensa* Butler.]

[Jordan (1911) has proposed the name *R. zuleika* subsp. *orites* for the common form at Sikkim, generally called *zuleika*.]

[*Geographical distribution.*—Northern India; Thibet.]

RINACA EXTENSA Butler.

Plate XCVIII, fig. 1.

Rinaca extensa Butler, Illustrations Lep. Het., V, p. 61, Pl. XCIV, fig. 2, 1881.
Rinaca extensa Kirby, Syn. Cat. Lep. Het., I [p. 761].

Imago.—"♂. Near to *R. thibeta*, but considerably larger; the primaries more elongated and considerably more falcated in form; the ocelli larger, that of the secondaries circular; the two dark bands across the primaries darker, more regular, oblique, not incurved toward the costa; the gray area beyond the zigzag discal lines of only two-thirds the width and less rosy in color; the outer border darker; the subbasal band of the secondaries dark brown, strongly dentated below the middle; the discal lines wider apart, the inner one paler, the outer one dark brown; the discal belt considerably darker; the submarginal stripe olivaceous instead of gravel-yellow.

Expanse of wings 5 inches 9 lines.

"Darjiling (Lidderdale).

"Mr. Moore possesses the female of this species, also from Darjiling; it differs from the female of *R. thibeta* in the same way as the male does."

NEORIS Moore.

Plate CII, fig. f.

[*Neoris* Moore, Trans. Ent. Soc. Lond., (3) I (1862), p. 321.]

[Rothschild, Nov. Zool., II, 1895, recognizes a single species, which he considers the type of the genus.]

(1) *N. shadulla* Moore.

[However, *N. huttoni* Moore is the type of *Neoris*, as stated by Kirby. *N. shadulla* was not described until 1872. Rothschild referred *N. huttoni* and *N. jonasi* to *Saturnia*. More recently Dr. K. Jordan has used *Neoris* as the proper generic name for *huttoni*, which is said to have, in addition to the typical subspecies from northwest India, three other forms: (1) *stolizkana* Fldr. (*shahdulla* Moore), from Ladak and Yarkand, at over 12,000 feet altitude; (2) *galerope* Püng., from Persia; (3) *schencki* Stgr., from Saisan, Alexander Mountains, and Ferghana.]

CALIGULA Moore.[1]

[*Caligula* Moore, Trans. Ent. Soc. Lond., (3) 1 (1862), p. 321.]

[Rothschild, Nov. Zool., 1895, p. 44, has listed the species as follows:]

1. *C. simla* (Westw.). [Northern India.]
   subsp. *japonica* Butler. [Japan.]
2. *C. cachara* Moore. [Cachar.]

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[1][Jordan (in Seitz, 1911) uses *Caligula* in an entirely different sense for the following species:
C. thibeta Westw. Northwestern Himalayas.
C. extensa Butler. India.
C. boisduvalii Ersch. South of Lake Baikal.
subsp. *fallax* Jordan. Vladivostok, Askold, Ussuri to the Amur.
subsp. *jonasi* Butler. Japan.
C. lindia Moore. Himalayas.
subsp. *bonita* Jordan. Tibet.
C. bieti Oberth. Western China.
C. anna Moore. Northern India, southern China.
C. grotei Moore. Northern India.]

3. *C. helena* (White). [Australia, Tasmania.]
4. *C. intermedia* (Luc.). [Gippsland, Brisbane.]
5. *C. eucalypti* (Scott). [Sydney, N. S. W.]

[Mr. J. H. Watson (litt. 1912) writes: "*Caligula* has its type *thibeta* (Moore)", a species not included in the above list.]

[Venation: In the Asiatic *C. simla* and *japonica* (*Dictyoploca* Jordan), III_{1-3}, are all joined to end. In the Australian *C. helena*, III_1, III_2, and III_3 are all separate. The Australian species are to be placed in a new genus **Austrocaligula,** type *Austrocaligula helena* (*Saturnia helena* White, 1843).]

CALIGULA [DICTYOPLOCA] JAPONICA Moore.

Plates XXVIII, figs. 1*, 2–5; XL, fig. 4; XLII, figs. 1–4.

Caligula japonica Moore (pupa case), Trans. Ent. Soc. London, (3) 1, p. 322, 1862. Technologist, No. 37, p. 7. imago 1862.

Caligula japonica Butler, Ann. and Mag. Nat. Hist., (4) XX, p. 479, 1877. Illustrations of Lep. Het. Brit. Mus., II, p. 16, Pl. XXVI, fig. 2, 1878.

♀. Differs from ♀ *Antheraea pernyi* and *yama-mai* by the less acute fore wing, which is less falcate, and the antennæ with shorter feebler pectinations. No extradiscal broad band, but instead two zigzag parallel faint brown lines. Ocelli on fore wing one half as large as in *yama-mai,* the yellow center of ocellus of hind wing of *yama-mai* replaced by fawn brown. Its primitive character is seen in the fine transverse lines, two near base, one extradiscal, in one of the females passing through the ocellus, and two halfway between eye and edge of wing. The lines less distinct beneath. Subapical black spot present. A white oblique streak on first apical cell. Two females from Japan, Clark collection (Brown University).

A large number of the eggs of this species were received through the kindness of Prof. C. Sasaki of the Agricultural College, Imperial University, at Tokio. They began to hatch March 31. Many of the eggs contained Pteromalid parasites in the pupa state; these emerged at the same time as the larvæ, and probably stung them, since they all died before completing their transformations, though several molted five, and one six times.

It being too early for the natural food, which Prof. Sasaki informs me is the chestnut (though the buds were given them), they ate sparingly at first of willow buds, and afterwards the leaves, so that after stage II the larvæ were apparently undersized, and the measurements here given will probably not apply to those raised in the air in their native country.

Egg.—Cylindrical, more so than usual; each end obtuse and well rounded; the shell is of a peculiar dull whitish-gray hue, irregularly mottled with blackish. The surface is seen under a strong lens to be finely pitted. Length 2 mm.; diameter 1 mm. The hole eaten by the larva for its exit is situated at the extreme end.

Larva.—Stage I: Length when hatched 5–6 mm.; width of head 1.01 mm. The head is nearly as wide as the body, jet black. The larva is of the usual Saturnian type, and appears much as in that of *Telea* and *Tropaea;* the body cylindrical, rather thick, though a little slenderer than in *Telea,* etc., and with two separate dorsal tubercles; and is armed with large tubercles, which give rise to radiating dark setæ. The tubercles are black like the body.

On March 31 all were black, but on the next day (Apr. 1) in three examples the tubercles were livid white, as also the midabdominal legs; while the hairs on the back from the dorsal and supraspiracular tubercles are black, those on the side of the body are pale. Yet these individuals had not freshly hatched, as there were no egg shells in the box with them.

The tubercles and their size relative to the body much as in other Attacine larvæ in their first stage; they are high, well developed. Those of the tergum of the prothoracic segment are minute, arising from a pale plate or area, and are about a fifth to a quarter as large as those on the segments behind. On thoracic segments 2 and 3 and on the abdominal segments all the tubercles of the two dorsal rows are a little higher than thick, giving rise to eight to nine dark radiating unequal hairs, one or two of which are longer, sometimes nearly twice as long as the others; they are on the average about one-half as long as the body is thick. They are

minutely barbed, the barbs being short. The two dorsal tubercles on the eighth abdominal segment are no higher than those in front, all being of uniform height. There are hairs on the supraspiracular tubercles.

At the end of this stage (Apr. 16–17) the larvæ became 8–12 mm. in length, though the head is no larger than at first.

The body is livid brown-black, but paler on the under side, almost glaucous-green, with a yellowish tinge, so that the lateral or pleural fleshy ridge becomes *a faint greenish-yellow line.* The tubercles are jet-black, and the hairs black, with gray ones intermixed.

Other examples before molting have a pale dull whitish band extending across the labral region of the head, and *a lateral row of livid pale whitish spots.*

Stage II: Molted April 16–17. Length of body 11–12 mm., width of head 1 mm., about twice as great as before. Directly after molting the head, legs, and tubercles are *all* white. The lateral broken line or series of pale greenish-yellow lateral linear spots is *much more* distinct than before, being now conspicuous, while the body is dull livid blackish. Now there are *scattered over the body long white hairs, and similar ones form the central one or two setæ in each tubercle;* they are about one-third as long as the whole body, but in the lateral or infraspiracular row of tubercles all the radiating hairs are long and whitish. The white hairs are most abundant on the prothoracic plate and head. The short hairs on the body are still black. Under side of the body livid.

Stage III: Molted the second time May 1. Length 24 mm.; head larger, width 2.5 mm.

The most decided change is in the prothoracic hairs and those on the sides of the body, which are straw-yellow, while the anal legs are edged with straw-yellow. The longest dorsal hairs are about a quarter to a third as long as the entire body. The body is still rather long and slender, and much more hairy than in the larva of *Antheraea.* The tubercles are still more prominent, black, the ends and the tuberculets livid. The hairs are long, not stiff, but a little crinkled, and they partially conceal the tubercles. The latter are still all of the same size.

Stage IV: Third molt occurred May 17–20.

Length of body 22 mm.; width of head 3 mm.

There is now a decided change in coloration and markings. The head is nearly as wide as the body, black, the clypeus-anterior white; labrum yellowish; the head armed with long uneven yellow hairs.

The body is still only moderately thick, and is long and slender, not at all like Antheraea in shape; the segments are not convex, but flat, and of the same thickness to the end of the body, but the anal legs are large and triangular.

The tubercles are larger and more prominent than before, and very conspicuous, as they are white or yellowish white. The prothoracic plate bears long hairs, and on this segment there are no decided dorsal tubercles, the vestiges being low and flattened, while the lateral ones are fairly prominent and black.

The second and third dorsal thoracic tubercles are no larger than the abdominal ones; those of the third thoracic segment a little larger, however, than those on the second thoracic segment; and those on the sixth abdominal segment a little larger than those on the seventh and eighth segments (one on the sixth is larger than its mate).

The two dorsal tubercles on the eighth abdominal segment are separate, like the others, and show no signs of coalescence; they are slightly larger than those on the ninth segment, which are also separate.

Each dorsal tubercle gives rise to about four radiating stout, sharp, slightly dusky setæ, while from the center rises a very long yellow hair, or more often two or three, usually three such hairs; the skin between the tubercles bears on the top and sides of the body long fine white hairs. The longest yellow hairs are about one-third longer than the body is thick. The area around the base of the tubercles is white, due to crowded flattened snow-white warts, which are crowded around the base of the tubercles and scatterred between so that the dorsal region is white, though interrupted; the sides of the body are black, inclosing the dull livid spiracles.

The oval flattened tubercles are scattered along just above the pleural swollen yellow line and beneath on the under side, where they become straw-yellow. The tubercles of the ninth abdominal segment bear setæ which are mostly black or dark. The tubercles of the supraspiracular row are prominent, but small, pale, and bear eight to nine short pale setæ, with a very long yellow one (sometimes two) arising from the center. Those of the infraspiracular row are about twice as large as those of the supraspiracular series, and bear about nine setæ arising from prominent warts, while the setæ assume the shape of long uneven yellow hairs.

The thoracic legs are black; the mid-abdominal ones pale greenish-yellow with the plantæ reddish; anal legs large, broad, triangular, black, spotted in the center with yellow and with yellow hairs around the edge, but none arising from the central portion. Suranal plate broad, triangular, a little shorter than broad, roundish at the end, with setiferous white warts, the hairs around the edges yellow; two groups of seven to eight setæ, one on each side near the edge, arising from distinct warts; each group, representing a primitive tubercle, is situated a little nearer the base of the plate than the end.

The setæ on the supraspiracular tubercles of the eighth abdominal segment are also dark.

In this stage it is a rather conspicuous larva and a very beautiful one.

Stage V: It molted again June 3. It is now a most beautiful larva.

Length of body 35–40 mm. Width of the head 4–4½ mm.

Head nearly as wide as the prothoracic segment, greenish straw-yellow, spotted with brown, the sides brown; a V-shaped dark line in front, each side of the clypeus being black.

The body of a beautiful tint of pearly greenish-white; the top of the body being broad uniformly flattened, the sutures between the segments being shallow. The tubercles are distinct, but of uniform size, and about as high as thick, bearing seven rather stiff setæ, one rising from the center; the setæ of the lateral tubercles are twice as long as the dorsal ones. Behind the tubercles each segment is crossed by two transverse impressed lines. On the ninth abdominal segment a few of the radiating setæ are blackish or entirely black.

The body is very hairy for a Saturnian, being clothed with long pale whitish-yellow uneven hairs, the longest nearly twice as long as the body is thick; those on the side of the body bright straw-yellow. The lateral ridge and the tubercles of the two lateral rows are straw-yellow. Around the base of each infraspiracular tubercle is a reddish ring.

The spiracles are large, conspicuous, of a rich delicate turquoise-blue. Around each spiracle are several irregular small linear black spots and streaks, which are directed more or less upward and broken up into dots. The thoracic segments are black on the sides low down and on the under side. The separate warts on the sides of the body and on the outer sides of the midabdominal legs are rather large.

The suranal plate is rounded, as in the earlier stages, and with the anal legs spotted with black, and clothed with short curly pale yellow hairs.

Thoracic legs brownish; midabdominal legs yellow ochre, like the under side of the body, but above the planta greenish-yellow.

Stage VI: It molted for the fifth time June 12–13.

Length of body 40 mm.; width of the head 4½–5 mm.

The head is now entirely black, except the base of the labrum. The sides of the body (what before was straw-yellow) are now *all black, this tint extending far above the blue spiracles.* The upper edge of this black region is irregularly dotted with white; the under side of the body is also black.

The top and middle of the prothoracic plate is white, divided into two halves by the median line. *The dorsal or upper side of all the segments to the end of the eighth abdominal segment is cream-white.* The tubercles are also greenish-white; each bear six to seven long setæ and one or two central ones, which are greenish and as long as the body is thick.

The suranal plate and anal legs greenish-yellow, with black dots and streaks. Thoracic legs chestnut brown: midabdominal legs dark green with dark plantæ. Mr. Joutel tells me that some of his larvæ had an extra stage.

CALIGULA SIMLA (Westwood).

Plates XLI, fig. 1; XCVIII, fig. 3.

CALIGULA [AUSTROCALIGULA] HELENA (White).

Plate XL, fig. 5.

GRAELLSIA Grote.

Saturnia Graells, Annales Soc. Ent. France, Pl. 8, 1850.
Attacus Rambur, Cat. Syst. Lep. Andalousie, p. 378, 1858.
Saturnia Millière, Annale Soc. Linnéenne Lyon. (Nouv. Sér.), XVIII, p. 1, 1872.
Actias Maassen and Weymer, Beitr. Schmett., III, figs. 40, 41, 1873.
Tropaea Kirby, Syn. Cat. Lep. Het., I, p. 765, 1892.
Graellsia Grote, Die Saturniiden, Mitth. a. d. Roemer Museum, VI, p. 26 (no descr.), 1896.

Imago.— ♂, ♀. Head moderately wide between the eyes, the front being covered by long irregular hair-like scales; ♂ antennæ very broad, pectinated to the tip, the joints unusually long; those of ♀ primitive in structure, the distal pectinations less than one-half as long as the proximal ones, the branches ending in a few scattered setæ toward the end and at tip. Palpi small, not visible, being concealed by the hairs of the front; they are depressed, and are more vestigial than in *Actias*.

Fore wings equilaterally triangular, not falcate, the outer edge a little longer than the inner, and only between one-fourth and one-fifth shorter than the costal edge. Hind wings in ♂ with a short narrow pointed tail, less than one-half as long as the entire wing and also shorter than the wing is wide; in ♀ the tail forms only a broad angle or projection turned outward, and less than half as long as tail of ♂. The wings are thin, the squamation being comparatively sparse.

Venation: In fore wing vein II_1 and II_2 wanting. (For other details see Pl. XLIII, figs. 3, 4.) The discal cell short, spur of vein VI_1 being the vestige of vein VII_1 is longer than in any of the group Actianæ or any Saturniid known to us.

Hind wings; ♂ vein III_3 and IV_1 arise very near together, in *Actias* they are far apart at their origin; the discal cell is short, the discal veins being situated at or only just beyond the middle of the wing.

Markings: Discal spots or ocelli all four alike and extending to the veins on each side of the discal area; they are round, those of the fore wings free, not connected by a band with the costal band; the distal veins pass through the middle, and on the outer side is a crescentic irregular clear space, the outer edge not being well defined. The rings of the ocellus are not continuous except the outer black one, the others are discontinuous; the middle semicircle blue inside, and represented on the outside of the discal veins by a much broader yellow semicircle. Three submarginal dark brown bands on the fore wings, two on the hind wings; no definite intradiscal lines. The costal band is lilac reddish, and the veins are widened in appearance by red scales, producing a very unusual effect. The wings are thin, not densely scaled, and of a delicate pea-green, but with more reddish brown than in the other genera. The body is clothed with loose wooly hairs, those on the thorax with scattered tufts of ochreous hairs. Abdomen reddish-brown, banded with pale ochreous fawn.

That the imago is a primitive ancestral form is strongly indicated by the very long vestige of vein VII (and part of the lack of veins II_1 and II_2), by the short tails, especially those of the ♀, the free ocelli of the fore wing, and especially by the *Samia*-like reddish body and the whitish ochreous bands of the abdomen, as well as the loose irregular squamation.

The great disparity in shape and markings between the sexes only affects the hind wings with their tails and the antennæ.

Larva.—In its generic characters the larva differs remarkably from those of the other genera of the group. The shape of the body is very primitive, much as in the Noctudiæ and in *Perisomena caecigena*, the body tapering toward each end, and being round and cylindrical. It is not ornamented with tubercles bearing spines, but the tubercles are low, flattened, button-

like, of nearly if not quite the same size on all the segments, and bear a few rather long fine hairs, those of the second thoracic and eighth abdominal tubercles being a little longer than the others. This is only a slight indication of a process of differentiation which is so marked in the more specialized genera. The number of tubercles on the eighth abdominal segment is apparently six, the same number as in *Saturnia* and allied genera. The lateral tubercles are small and are drawn in the figure as bearing but a single hair.

Cocoon.—Pear-shaped; with no stalk.

Pupa.—Of moderate thickness, the abdomen ending in several short and black points.

GRAELLSIA ISABELLÆ (Graells).

Plate XLIII, figs. 3, 4; LXXIII, figs. 3, 4; XCVII.

Saturnia isabellæ GRAELLS, Annales Soc. Ent. France, Pl. 8, 1850.
Attacus isabellæ RAMBUR, Cat. Syst. Lep. Andalousie, p. 378, 1858.
GIRARD, Metamorphoses Ins., p. 263, figs. 211 et 212.
Saturnia isabellæ MILLIÈRE, Icon. et. Descr. Chenilles et Lep., Annales Soc. Linn. Lyon. (Nouv. Sér.), XVIII, p. 1, 1872.
Actias isabellæ MAASSEN and WEYMER, Beiträges Schemtt., III, figs. 40, 41; 1873.
Tropaea isabellæ KIRBY, Syn. Cat. Lep. Het., 1, p. 765, 1892.
Graellsia isabellæ GROTE, Die Saturniiden, Mitth. Roemer Museum, VI, p. 26, 1896.

LARVA.

GIRARD, Métamorphoses Ins., p. 263, figs. 211, 212.
MILLIÈRE, Icon. et Descr. Chenilles et Lep., Annales Soc. Linn. Lyon (Nouv. Sér), XVIII, p. 1, 1872.
[CHAPMAN, Entom. Record, 1902, p. 126.]

Moth.—One ♂, one ♀. (Others seen.) Body brown madder-red, abdomen striped or banded with pale ochreous fawn. Wings delicate pea-green; veins widened by madder. Discal ocelli with an outer black ring, and on the inside of the discal veins a wide pale steel-blue semicircle, within red-pink and outside of the vein a broad yellow semicircle. No intra and extra discal lines, but three submarginal brown lines, of which the inner is about one-half as wide as the middle one. Edge of wings all around madder red-brown. Beneath exactly as above, including the ocelli, though the blue is less distinct.

Expanse of fore wings, ♂ 80; ♀ 82 mm.

Length of fore wing, ♂ 44; ♀ 45 mm.; length of hind wings ♂ 52 mm., of ♀ 37 mm.

There is a slight variation in the size of the ocelli, those of the ♀ not reaching the median vein.

Larva.—It is described by Millière as cylindrical, the body being provided with button-like tubercles bearing brown hairs which are longest on the second thoracic and eighth abdominal segments. He does not refer to the number of tubercles on this segment.

The markings are interesting as being protective like those of other larvæ which feed on the pine, such as those of the sphingid moth *Ellema* and certain Noctuidæ. The ground color of the body is apple green. The dorsal band and the cross-bands are reddish, while the two series of lateral square white spots give it the checkered appearance seen in other caterpillars which live among pine leaves. There is a wide reddish brown dorsal band edged with whitish on each side. Abdominal segments 1–8 transversely faintly banded with reddish brown, each band or circle on each side being regularly divided by two diagonal yellowish-white spots. Over the body is scattered numerous yellowish-white spots. The anal legs are of the same shape as the other abdominal ones.

Cocoon.—Pear-shaped, without a stalk, spun among the needles, varying in color from reddish brown to whitish blonde.

Pupa.—Moderately thick, oval, with the last segment ending in several short, black points.

Food plant.—Pinus maritima.

Geographical distribution.—This interesting form is restricted to a single small area or locality on the heights around Madrid, Spain. [Sierra de Guadarrama, north and east of Madrid.] The fact of its being limited to such a circumscribed spot in southern Europe, as well as its prim-

itive character, suggests that it is a survival possibly of miocene tertiary times, and that it once ranged over at least the whole Eurasian continent and possibly north Africa, and may have been the stem or ancestral form from which the group of green-tailed Attaci originated.

[Mr. J. H. Watson writes (litt. April 30, 1912): "I have 4 ♂ and 3 ♀ *G. isabellæ* from Spain, alive. I shall photograph these on a spray of *Pinus maritima* which I have growing in the garden. The green-brown outlined nervures exactly harmonize with the pine needles. It is as though two eyes were looking at you through them."]

ARGEMA Wallengren.

Argema Wallengren, Œfv. Vet. Akad. Förh., XV, p. 140, 1858.
Angas Wallengren, Vet. Akad. Handl. (2), V, (4), p. 24, 1865.
Argema Kirby, Syn. Cat. Lép. Het., p. 766, 1892.

[Rothschild, Nov. Zool., II (1895), p. 47, lists the species thus:]

1. *A. mimosæ* Boisduval. [Type of genus according to Kirby.]
2. *A. mittrei* (Guérin).
3. *A. mænas* (Doubleday), of which *A. leto* (Doubleday) is the male.
4. *A. ignescens* Moore. [Genus *Sonthonnaxia* Watson.]

Imago.—Front of head moderately broad; the squamation close. Antennæ of ♂ broadly pectinated, but with the tip nearly filiform; the joints short. In ♀ well pectinated, but the pectinations only about half as long as in ♂; the distal pectinations but a little more than one-half and less than two-thirds as long as the proximal ones, and with a few scattered setæ at or near the tip.

Palpi small, depressed, nearly reaching the front. Tongue not visible.

Fore wings broadly triangular, outer edge one-fourth shorter than the costa, the latter inclined to be much curved towards the apex, which is sharp; outer edge straight or a little falcate; outer edges of both wings either entire or slightly scalloped. Hind wings with extremely long tails, the latter being twice as long as the main portion of the wing, the edges along the middle are turned or rolled up, and the end widens out oar-like or like a scalloped paddle; the tail is either decidedly contracted in width (*A. mimosæ* and *leto*) or slightly so in *mænas*.

Venation: Fore wings, veins II_1 and II_2 are present in *A. mimosæ*, but in *leto* and *mænas* II_1 is wanting. Vein II_2 is remarkably short. Vein II arises near the end of I. The discal cell is very short. Hind wings; origin of IV_2 remote from discal vein; the distance from the origin of IV_1 is twice as great as that between the origins of III_3 and IV_1.

Markings: Ocelli of varying shape, being perhaps most generalized or primitive in *A. mittrei;* they are in this species round, and on the fore wings free from the costal band, not being stalked; and those of both fore and hind wings are similar in shape and size; in the two more specialized species, *A. leto* and *mænas*, those of the fore wings are crescentic and are fused with the costal band. Two lines on the fore wings, retained so to speak from *Graëllsia* or a related extinct form, beyond the ocellus are present, and are better developed than in *Actias*, where they tend to disappear. The moths are of great size, on the whole comprising the largest species of the group.

Thus far the transformations of these magnificent moths are unknown.

Geographical distribution.—Of the five species known three are confined to the oriental region of the Arctogæic realm, one to the eastern coast region of Africa (Ethiopian region), and a single species to the Malagasy region.

SYNOPSIS OF THE SPECIES.

4. Ocellus of fore wings crescentic; extradiscal line and basal line, no submarginal lines, or the heavy broad bands of *A. leto;* tails broad.....*A. mænas* [♀].
3. Ocellus of fore wing crescentic; two submarginal lines, both heavy and extending to the costa....*A. leto* [*mænas* ♂].
2. Ocellus of fore wing round ovate, connected by a stalk with costal band; two submarginal lines, the outer broad and extending only half way across the wing.....*A. mimosæ*
1. All four ocelli large, round, those of fore wings either free or stalked; two scalloped slender, submargina. lines.....*A. mittrei*

ARGEMA MITTREI (Guérin).

Bombyx mittrei Guérin, Revue Zool., p. 230, 1847.
Actias cometes Guér., Vinson, Voy. Madag., Lép., p. 46, t. 7, 1864.
Actias cometes Maassen Beiträge Schmett., 1, fig. 9, 1869.
Tropæa madagascariensis Bartlett, Proc. Zool. Soc. London, p. 336, 1873.
Actias idæ Felder, Reise d. Novara, Lép., IV, Tab. LXXXVIII, fig. 1, 1874.
[*Argema mittrei* Kirby], Syn. Cat. Lép. Het., p. 767, 1892.
Argema mittrei Maassen and Weymer, Beiträge Schmett, IV, fig. 65, 1881.

[*Geographical distribution.*—Madagascar.]

Imago.—(Paris Museum.) With three well-marked reddish-brown bands; ocelli large, round, and on fore wings connected with costa.

ARGEMA MIMOSÆ (Boisduval).

Plate LXXIII, fig. 5.

Saturnia campionea Signoret, Ann. Soc. Ent. France, 1845, Journ. Proc., XCVII [no description].
Saturnia mimosæ Boisduval, Deleg., Voy. Afr. Austr., II, p. 600, 1847.
Saturnia mimosæ Westwood, Proc. Zool. Soc. London, p. 47, No. 11, 1849.
Saturnia mimosæ Angas, Kaffirs Illustr., t. 30, fig. 18, 1849.
Tropæa mimosæ Walker, Cat. Lép. Het. Br. Mus., VI, p. 1261, No. 3, 1855.
Actias mimosæ Maassen, Weymer, and Weyding, Beiträge Schmett, III, figs. 35, 36, 1873.
Argema mimosæ Kirby, Syn. Cat. Lép. Het., 1, p. 766, 1892.

One ♂, one ♀. Fore wings decidedly falcate, wings of both pairs yellowish green. Costa of fore wings much curved, apex sharp, outer edge slightly scalloped. Costal gray, madder or wine-red band unusually broad and spreading behind vein II at base of wing and also toward the apex. Ocellus round, slightly ovate, the transverse diameter greater than the longitudinal, the clear space a very narrow oval area or slit situated on the outer side of the discal vein, and about one-third as long as the entire ocellus. An outer dark-brown ring, wide on the inner side, very narrow on the outer, succeeded by a steel-blue narrow semicircle, followed by a dull reddish orange-ochre semicircle, the outer edge of which is ochreous brown; the innermost ring is fawn brown, wide, and inclosing the clear area, and paler beyond than within the discal veins. On the outer side between this and the outer ring the outer hemisphere of the ocellus is filled with a delicate greenish yellow. The discal veins are unequally developed, the anterior one is thick, ending before reaching the middle of the discal cell, while the hinder vein is very narrow, almost obsolete. Extradiscal line situated near the ocellus, not continuous but broken, represented by spots on the veins, being obsolete in the interspaces. A second parallel line beyond, obsolete on the front half of the wing, but widening towards the hinder edge, and becoming several times as thick as the extradiscal line. Edge of the wing scalloped with red brown; fringe reddish brown; no submarginal line.

Hind wings ending in very long narrow tails, longer than the rest of basal portion of the wing; the tails are very narrow in the middle and widen at the end; grizzly red-brown on the basal half, this shade extending up along the outer edge of the wing. Discal spot situated unusually near the outer edge of the wing, rounder than that of the fore wing, the inner brown circle smaller, but the clear area slightly wider. No bands on the hind wings except faint traces of an oblique one at the base of the tail.

Beneath, the venular spots are larger than above. Ocelli as above, but faded.

Body whitish, a lateral short broad brown band on each side of the abdomen. Side of the head, legs, and palpi deep claret-red, legs white on the inside of the femora.

Expanse of forewings, ♂ 108 mm.
Length of forewing, ♂ 58 mm.
Breadth of wing measured across ocellus, ♂ 31 mm.
Length of hind wing, ♂ 100 mm.; to base of tail, 46 mm.; tail, 54.
Breadth across ocellus, ♂ 32 mm.
Ocellus of forewing 6½ by 5; of hind wing, 5½ by 6½ mm.

The ♀ differs from the ♂ in the forewings being wider, though the ocellus and lines are the same. Both wings, however, are more distinctly scalloped, especially the hind wings. Ocellus of forewings measures 6 by 7 mm. The hind wings are shorter, the tail being much shorter, and flaring more at the end. The ocelli of the hind wings (8½ by 7 mm.) are larger than in the ♂, more oval or elongated, and the brown center is about twice as large, though the clear space is of about the same size; the orange-brown (Mars orange) semicircle is. however, wider, more pronounced than in the other sex.

On the underside the outer semicircle of the ocellus of the forewing is Mars brown instead of yellowish ochre, and the ocelli of both pairs of wings are larger than in the ♂.

Length of forewing, ♀ 60 mm.
Breadth of forewing, ♀ 34 mm.
Length of hind wing, 94 mm.; of tail, 46 mm.
Breadth of hind wing, 35 mm.

Geographical distribution.—Natal; Abyssinia.

Cocoon.—(Paris Museum.) Dense, oval, with no stalk. Surface on outside somewhat rough. Close dense, bright, shining silvery white, with a zone of roundish openings in two alternating rows in front near the end. It is quite regularly oval, each end nearly alike. It is not stalked, and is spun as a leaf. Length, 45 mm; diameter, 20 mm.

The natives of Natal make anklets of the cocoons. According to Dr. L. O. Howard, they "collect the cocoons after the moth has issued, put one or more small stones into each cocoon, and sew them onto a broad strip of monkey skin, side by side, so as to cover the surface of the skin. They are sewn to the raw side of the hide, the fur being on the opposite side. The anklets received [from Mr. Claude Fuller, Government entomologist of Natal] are 10 inches long by 4 inches wide and are attached to the strips by means of thongs of the same hide. The cocoons are tough and dry, and the stones within them rattle in a most delightful way. * * * The use of these ankle rattles has become quite general in Natal since the introduction of the rickshaw from China and India. The rickshaw bearers wear the anklets very generally, and their rattle on the streets is almost as familiar as sleigh bells in a New England town in winter." (Sci. American, 1900.)

ARGEMA [SONTHONNAXIA] MANEAS Doubleday.

Plate L, fig. 8; XCVI.

Actias maenas Doubleday, Ann. and Mag. Nat. Hist., XIX, p. 95, Pl. VII, fig. 1, 1847.
Actias maenas Westwood, Cabinet Oriental Ent., p. 45, t. 22, 1848.
Tropaea maenas Walker, Cat. Lep. Het. Br. Mus., p. 1253, No. 3, 1855.
Actias maenas Maassen and Weymer, Beiträge Schmett., II, figs. 25, 26, 1872.
Argema maenas Butler, Syn. Cat. Lep. Het., 1 p. 767, 1892.

One ♀. The largest species of the genus. In my single ♀, the original type of Doubleday, now entirely faded out, the forewings are broad, the costa quite convex, the outer edge of wings of both pairs distinctly scalloped. The tails are unusually broad, being twice as wide in proportion as in the other species, and widening but little toward the end.

It will be seen by reference to the figures of the venation that each species differs structurally as well as in shape and coloration. In the present species, compared with *A. mimosae*, the discal cell is noticeably shorter, broader, and rounder at the outer end, the discal veins are very thick and curve outward; as in *A. leto*, there is no vein II_2; on the hind wings the ocellus is nearer the middle of the wing, and there are other minor differences. The ocellus of the forewings is situated beyond the discal veins and is crescentic, somewhat as in *A. leto*.

Doubleday describes the moth as greenish yellow, with the costa ferruginous sprinkled with cinereous, with a basal and an extradiscal flexuous line. The ocellus nearly black internally, marked with a delicate white line. That of the hind wings being a small lunule divided by a white line resting on a faint cloud, darkest on the inner side.

Expanse of forewings, 200 mm.

Length of forewing, 94 mm.; breadth across the discal spot (ocellus), 54 mm.

Length of hind wing, 165 mm.; to base of tail, 62 mm.; tail, 103 mm.; width of tail at narrowest point, 9 mm.

Geographical distribution.—Silhet.

[Rothschild and Jordan (1901) have described a form as *A. moenas latona.*]

ARGEMA LETO Doubleday [=male of A. maenas].

Plate XLIII, fig. 2; XCVI, fig. a.

Saturnia leto DOUBLEDAY, Proc. Ent. Soc. London, V, p. li., Pl. 15, 1848.
Tropaea leto WALKER, Cat. Lep. Het. Br. Mus., VI, p. 1263, No. 6, 1855.
Actias leto MAASSEN, Beiträge Schmett., 1, fig. 10, 1869.
Actias diana MAASSEN, WEYMER and WEYDING, Beiträge Schmett., 11, fig. 12, 1872.
Actias leto MAASSEN, WEYMER and WEYDING, Beiträge Schmett., V, figs. 106, 107, 1855.
Actias leto PREISS, Abbild, Nachtschmett., p. 5, 6, fig. 1, 1888.
Actias leto KIRBY, Syn. Cat. Lep. Het., p. 767, 1892.

Imago.—One ♂. Head as in *A. mimosæ*, in front as wide as and much as in *A. mimosæ*, forewings, costa rather more curved, the hind edge of the wing straight, not so full and convex as in *A. mimosæ*, the outer edge less convex, straight. The costal band is limited to the costal edge, not spreading backward over vein II. Ocellus crescentic or sickle-shaped, one horn resting directly on the costal band; it is about three times as long as broad, the convexity facing inward, dull orange red-brown edged externally with darker red-brown, then a blue semicircle inclosed in a dark tan-brown semicircle; no clear space. Wings lemon yellow; forewings yellow at the base, beyond is a very broad, dull "brown-pink" band reaching to the grizzly brown costal band and inclosing a triangular post-costal yellow spot. Extradiscal line brown-pink, rather sharply zigzag, coarse, and heavy, succeeded beyond by a broad zigzag concolorous band, which is very wide on the costal edge, and reaches to the apex, becoming very wide on the hinder angle of the wing, reaching to the outer edge from vein IV backward. There is no vein II_1. The discal veins are nearly straight and very slender. Hind wings with a remarkably long tail, twice as long as the rest of the wing, very narrow in the middle, and spreading out in a spatulate way at the end; basal three-fourths brown. Outer margin of the wing lilac pink-brown; and the base pink-brown, extending back to the base of the tail. Ocellus round, small, with a dark outer semicircle in front.

Beneath are three lines, one within and the two others beyond the ocellus; they are narrower than above. Base of wings of both pairs lemon-yellow, as well as the rest of the wings.

Expanse of forewings, 160 mm.
Length of forewings, 73 mm.; breadth, 40 mm.
Length of hind wings, 140 mm; to base of tail, 50 mm.
Length of tail, 90 mm.
Breadth of hind wing, 32 mm.
Width of tail at narrowest part, 3 mm.
Ocellus of forewing above, 10 by 4½ mm.; beneath, 4 by 2½ mm.
Ocellus of hind wing above, 5 by 5½ mm.; beneath, 4 by 3½ mm.

Geographical distribution.—Restricted to the oriental region. Eastern India (Swinhoe) Silhet (Doubleday); Java (Maassen). Specimens from Java do not appear to present important differences from the Indian ones, the lines only varying in distinctness and width.

ARGEMA [EUANDREA] DUBERNARDI (Oberthür).

[*Tropaea dubernardi* OBERTHÜR, Bull. Soc. Ent. France, 1897, pp. 131, 174.]
Tropaea dubernardi JOANNIS, Bull. Soc. Ent. France, 1898, p. 326.

This is allied to but very different from *A. ignescens* Moore, the Javanese form or race of *A. leto*. It differs very much from *A. mænas*. The ocellus of the forewing is connected with

the costa. The forewings are very narrow and the apex rather sharp, while the apex of the hind wing is much rounded. The tails are very long, nearly three times as long as the wing itself. There is no trace of an ocellus on the hind wings. The outer margin of the forewings for a quarter of an inch is dull orange-red, as is the outer edge of the hinder pair. The tails are entirely dull orange-red, except the ends, which are green.

Geographical distribution.—W. China. [Type of Genus *Euandrea* Watson.]

ARGEMA BESANTI Rebel.

[*Argema besanti* Rebel, Verh. Ges. Wien., 1895, p. 69.]

This species is congeneric with *A. mimosæ*. The example in the British Museum is from a point 150 miles northeast of Mombasa, East Africa. It is a singular, small species, expanding $2\frac{3}{4}$ to 3 inches. Fore wings short, triangular; ocellus not connected with the costa, but a broad tooth or projection extends toward it from the costa. Ocellus of hind wings small, venetian-red in the middle, an outer brown ring, no vitreous line or spot. A broad lilac-brown extradiscal band, edged broadly within with white, which crosses the discal veins. The extradiscal band on the hind wings is faintly marked. The tails are expanded at the ends, mostly lilac brown, and green at the end.

ACTIAS Leach.

Actias Leach, Zool. Misc., II, p. 25, 1815.
Tropaea Hübner, in part, Verzeichniss, 152, 1816 (1822?)
(*selene* is mentioned by Hübner *after luna*.)
Plectropteron Hutton, Annals and Mag. Nat. Hist., XVII, p. 60, 1846.
Tropaea Walker, Cat. Lep. Het. Br. Mus., VI, p. 1262, 1264, 1855.
Actias Maassen and Weymer, Beiträge Schmett., II, fig. 16, 1872.
Actias Preiss, Abbildungen Nachschmett., p. 6, t. 6, fig. 2, 1888.
Actias Kirby, Syn. Cat. Lep. Het., I, p. 766, 1892.

Imago.—Head as in *Argema*, the front of the same width and smooth; ♂ antennæ not so suddenly subfiliform at tip as in *Argema;* with short joints; pectinations long. In ♀ *A. artemis* the antennal joints are very long, in their middle the distal pectinations are about one-half as long as the proximal, becoming gradually shorter toward the tip; the pectinations are clavate, with four to six setæ near and at the end. Labial palpi rather large, distinct, 3(?) jointed, broad, the third joint not distinct, longer than in *Tropaea*. Maxillae separate, but distinct, thick, not quite reaching to the middle of the palpi, those of *artemis* not quite so long as in *T. luna*. In *A. selene* the palpi are well developed, broad, curved up and nearly reach the front of the head, and the third joint is just visible; [the palpi] conceal the tongue unless depressed.

Fore wings longer, outer edge longer, a little more pointed at the apex and the costa is inclined to be more curved than in *Argema* and much more so than in *Tropaea;* outer edge long, not scalloped, and the wing tends to be more falcate, though this is not a generic character.

Hind wings with much shorter and broader tails than in *Argema* and *Tropaea*, and the tip of the tail is not so wide, or scarcely so, than the middle.

Venation: This genus differs from *Argema* in the longer discal cell and in the longer stalks of veins III_1, III_2. In the hind wings the distance between the origins of III_3 and IV is twice that between IV_1 and IV_2, being just the reverse of what obtains in *Argema*.

From *Tropaea* it differs in the discal cell of the fore wings being longer; in the subcostal area being narrower, though it varies in this respect, that of *selene* being narrow, and that of *artemis* wide, more as in *Tropaea*. The discal veins are remote from the origin of the vein III_1; vein VII tends to be longer than in *Tropaea*, indicating in *selene* a more primitive origin for the genus, though in *A. artemis* it is shorter. In the hind wings the discal area is also longer than in *Tropaea*, and the ocellus is much nearer the outer edge of the wing, while the three veins of the tail originate much farther from the discal veins.

Markings: Discal spots of moderate size (*selene*) or small (*artemis*), those of the fore wings free from the costal edge, having no stalk.

[Dr. Packard, without comment, has copied Rothschild's remark (Nov. Zool., 11 (1895), p. 47): "I can find no character to separate *Tropaea* from *Actias*." He has also copied Rothschild's list of the species, as follows (I add a subspecies more recently described)]:

1. *A. isabellæ* (Graells).[1] [Spain.]
2. *A. sinensis* (Walker). [China.]
3. *A. luna* (L.). [Genus *Tropaea*. American.]
   - ab. *azteca* (Pack.).
   - ab. *rossi* (Ross).
   - subsp. *dictynna* (Walker).
4. *A. selene* (Hübner).
   - subsp. *ningpoana* (Felder). [China.]
     - ab. *maasseni* (Kirby).
   - subsp. *artemis* (Brem.). [Amur.]
     - ab. *gnoma* (Butler). [Japan.]
     - ab. *dulcinea* (Butler). [Japan.]
     - ab. *aliena* (Butler).
   - [subsp. *callandra* Jordan 1911. Andamans.]

[Dr. Packard examined Maassen and Weymer's account of Kirby's *maasseni* from China (a ♀), and reached the conclusion that it was a true *Tropaea*, with venation as in *luna*, differing from *luna* in markings and shorter tails only. "A brown band connects ocellus with brown-red costa as in *luna*, but there is a *distinct* straight extradiscal brown band," and tails are only about half as long.]

ACTIAS SELENE Macleay. [Hübner.]

Plate XVII, fig. 2; L, figs. 6, 7; XCV.

Attacus luna Cramer, Papillons Exot., 1, p. 51, t. 31, Figs. A, B. 1775.
Tropaea selene Hübner, Sammlung Exot. Schmett., 1, 1806?
Actias selene Macleay, Leach, Zool. Miscellany II, p. 25, pl. 70, 1815 (Macleay).
Tropaea selene Hübner, Verzeichniss bek. Schmett., p. 152, 1816.
Plectropteron dianæ Hutton, Annals and Mag. Nat. Hist., XVII, p. 60; 1846 (no descr.); Trans. Ent. Soc. London., V, p. 45, 1847.
Plectropteron selene Hutton, Trans. Ent. Soc. London, p. 85, 1848.
Actias selene var. *ningpoana* Felder, Wiener Ent. Monstschrift, VI, p. 34, 1862.
Tropaea selene Walker, Cat. Lep. Het. Br. Mus., VI, p. 1262, No. 4, 1855.
Actias selene Hutton, Proc. Zool. Soc. London, p. 5, 1856.
Actias astarte Maassen and Weymer, Beiträge Schmett., II, fig. 16, 1872.
Actias selene Moore, Lep. Ceylon, II, p. 123, 1883.
Actias selene Preiss, Abbild. Nachtschmett., p. 6, t. 6, fig. 2, 1888.
Actias selene Kirby, Syn. Cat. Lep. Het., 1, p. 766, 1892.
[*Actias selene* Watson, Wild Silk Moths of the World, 1912, Pl. II. Colored figures of *selene* from Assam and subsp. *callandra* from Andaman Is.]

LARVA.

Moore, Trans. Ent. Soc. London, V, Pl. V, 1848. Full fed larva. Cat. Lep. Ins. Mus. East India House, p. 400, Pl. XIX, figs. 1, 3 (stage IV), 3a, (last stage), 1858–59.

Imago.—Three ♂, three ♀. Head white, thorax and abdomen white, a transverse prothoracic pink madder-red band connecting the costal edges of the fore wings; sides of the front of the head narrowly edged with pink-red. Palpi rather slender, reaching nearly to the front, red.

Fore wings acute, decidedly falcate, the costa much curved toward the apex; the outer edge distinctly incurved. Body and wings pale soft pea-green, tinged with yellow; fringe yellow and ends of the tails yellow. A faint greenish brown basal line which is not visible beneath; it is straight in its course and is rather far from the insertion of the wing. Two submarginal lines, the inner (extradiscal) being broader and more distinct than the outer. The extradiscal is present on the hind wing, but is bent at right angles at base of the tail.

[1] [This is now generally known as *Graellsia isabellæ*, and is so described above.]

The four ocelli much alike, oval round in the fore wings (those of the Indian form are swollen a little externally), the central clear area mostly situated on the outside of the discal veins, very narrow oval. On the inside of the ocellus is an outer separated by [from ?] an inner narrower shorter black semicircle by a slender blue semicircle; the inner black semicircle is edged within with pink-red. A yellow innermost line next to the clear area. On the outside is a hemispherical soft salmon-colored area, bounded externally by a broad straw-yellow ring (dimensions 6 by 6.5 mm.). Those of the hind wing are as in the fore wings but larger and with the outer edge bent, i. e., a little sinuous (breadth 6.5 by length 7.5 mm.). On the underside of the wings the ocelli of the anterior pair are rounder than above, very slightly smaller, and less distinctly marked. Those of the hind wings are also less distinct, being slightly faded. The tails pink in the middle, the pink shade extending backward and forward along the outer edge of the tail. Legs pink-red.

Expanse of fore wings, 157 mm.
Length of fore wing, 73 mm. (a small ♂ 63).
Breadth of fore wing (through ocellus), 39 mm.
Length of hind wing, 95 mm. (a small ♂ 76 mm); length to base of tail 50. Length of tail, 45 mm (small ♂ 32 mm); breadth 9 mm.
Breadth of hind wing, 36 mm.

In two small ♀ from northern China, and a large one presumably from China, the fore wings are not falcate, and the outer edge of the wings is convex rather than concave. The large ♀ is intermediate in the shape of the ocelli between normal *A. selene* and the Chinese subspecies *ningpoana* (Hongkong, Felder), as suppose this Chinese form to be.

This form is pure green, with no yellow tinge; the fore wings are broad, but the costa is much curved. It differs also in the inner side of the ocellus of the fore wings being rounder, more convex or swollen, and with more red next to the clear space; those of the hind wings being perfectly round (orbicular). The outer edge is neither angular or sinuous; there is no pink at base of tail which is green throughout, the fringe being white. (Is this a truly local Chinese form, or a seasonal form ?) The following measurements were taken from this individual:

Expanse of fore wings, 185 mm. (7⅓ inches.)
Length of fore wings, 91 mm.
Breadth of fore wing, 53 mm.
Length of hind wing, 120 mm.; length to base of tail, 68 mm.; of tail, 52 mm.; breadth, 11 mm.
Dimensions of ocelli of fore wings, 7 by 8 mm.; of hind wings, 7 by 7 mm.

The ocelli are not so wide as the discal cells, i. e., they do not extend so as to touch either vein III_3 or IV.

In the small ♀ from North China, an old bleached example, but white, the ocelli are round, and instead of the red on the outer side of the discal veins the scales are, in both wings, all yellow.

On the under side is a distinct sinuous narrow thread-like dark submarginal line (probably also present in the Indian form) common to both wings. The pink semicircle is much wider and more distinct than above, and the soft pale straw yellow of the large ♀ is here white and fades into the general white tone of the wing. The ocelli of the fore wings are not swelled out on the inside as in the large ♀.

Expanse of fore wings, 100 mm.
Length of fore wing, 50 mm.
Breadth of fore wings, 25 mm.
Length of hind wing, 66 mm.; to base of tail, 34 mm.; of tail, 32 mm.
Ocelli of fore wings, 3¾ by 3½ mm.
Ocelli of hind wing, 4 by 4 mm.

Geographical distribution.—The localities on the labels in the British Museum are: For China, Hongkong, Ningpo and Kiukiang (about lat. 29½° and long. 116°). Those for India and Thibet are Nepal, Silhet, Ceylon. It does not appear to occur on the lowlands of India, but is

restricted to the mountains of Nepal, Silhet, the Himalayas, at elevations of about 5,000 feet and upward. Hutton state that "This species, I believe, is confined to the hills from 5,000 feet upward to 7,000 feet, and perhaps higher; it also occurs in Silhet." (Horsfield and Moore's Cat. Lep. Insects of Museum East India House, 11, p. 404.) In the Paris Museum are examples of *A. selene* from India, Java (one very large), Silhet, Macao, and northern China. In China it ranges from the tropical coast to Shanghai and westward to the interior, and also in Yunnan.

Climatic races.—My notes made while examining the specimens in the British Museum are as follows:

The males from Ceylon, India, and Thibet appear to have more pointed fore wings than those from China.

Three small males from Thibet are smaller and have more acute fore wings than three males from China (Kwei-chow or Kui-chau, on the Yang-tze-Kiang River, about 800 miles west of Shanghai. In one of the males the hind wings are more pointed at the apex than the two others; they have the basal line. The ocelli are a little smaller. In these examples from Thibet and in a pair (♂ and ♀) from Omei-Shan, elevation of 3,500 feet,[1] the ocelli are smaller and less black on the inner edge than in those from Ceylon. Also three males from Kanagra, Thibet, have sharp apices of the fore wings. In one ♂ from Kanagra the ocelli of the hind wings show some aberration, being excavated on the outer edge; the same variation was noticed in a pair (♂ and ♀) from Mussooree, Himalaya Mountains.

It would appear from these facts that the Chinese form, *ningpoana* (Felder), is probably a climatic race, with slight though constant differences from the Indian and Tibetan form *selene* given by Cramer in 1775, who states that his examples came from the coast of Coromandel and also from Ceylon. The name *selene* was Hübner's. Hübner gives no locality, while the plate has no number and no text.

[A later penciled note gives the result of examination of *ningpoana* at the Paris Museum, as follows:]

Fore wings with two parallel faint slightly wavy dark lines, and one on hind wings; ocellus disconnected from costa; male fore wings pointed, female much less so.

Larva of A. selene.—From a blown specimen in British Museum. [Length about 78 mm.] Shape as in Moore and Horsfield's figure; head rounded, chestnut brown with a few long hairs in front; body cylindrical, segments as in *T. luna*, deeply incised, angular; prothoracic segment small, narrow, no tubercles, but in place of each of two dorsal ones are four slender spines, dark, arising from green conical bases, and a pink spine on each side low down, giving rise to two hairs. A pair of large dorsal tubercles on second and third thoracic segments, of the same size, green at base, then a black ring (red in Moore's drawing) and end orange-yellow, giving rise to five or six sharp slender spines, and two to three hairs, and a third or fourth very long hair, about three times as long as the tubercles. Two rows of lateral orange-red small rounded tubercles, one above and one below spiracular line on third thoracic segment. Abdominal segments 1 to 7 with a pair of orange-red similar tubercles, those of the lateral rows much smaller, those of the supraspiracular row about half as large as those of infraspiracular row. The single dorsal [tubercle] on eighth abdominal segment large, high, all green, and bearing four to five sharp small spines like those on thoracic segments and also giving rise to five long unequal hairs. Spiracles orange-red, with whitish lips. Lateral line orange-red above and yellow beneath. Anal legs brown along end or plantula (whitish edge of brown portion seen in Moore's figure, not seen in blown specimen); long black hairs arise from all and body has scattered shorter hairs.

Cocoon.—Oval, alike at each end, 1½ inches long and ⅞ inch thick; no stalk. [The cocoon of *A. selene* is reddish, but *A. callandra* (*A. selene callandra* Jordan) has the silk pure white; both have been figured by Watson, Wild Silk Moths of the World.]

[1] As we understand it, Omei-Shan is a mountain 11,100 feet high, situated east of Thibet in China, north of Yunnan, in lat. 29° and long. 102½°, near Kia-ting, and on the head waters of the Yang-tze-Kiang River. [Watson has described a subspecies *omeishana*.]

ACTIAS ARTEMIS (Bremer).

Plate XLIII, fig. 1; L, fig. 5.

Saturnia artemis Bremer and Gray, Beiträge Schmett fauna Noerd. China's, p. 76, 1853.
Tropaea artemis Bremer, Bull. Acad. Imp. Sc. St. Petersburg, III, p. 566, 1861; Lep. Ost. Sibiriens (Mem. Acad. Imp. Sc. St. Petersburg, VII e Sér., T. VIII, No. 1), p. 44; Pl. II, fig. 6 ♂, 7 ♀, 1864.
Tropaea artemis Motschulsky, Études Ent., 1, p. 64, n. 28, 1862.
Tropaea artemis var. *gnoma* Butler, Ann. and Mag. Nat. Hist., (4) XX, p. 480, 1877; Illustr. Lep. Het. Br. Mus., II, p. 17, t. 25, fig. 1, 1878.
Tropaea artemis var. *dulcinea* Butler, Trans. Ent. Soc. London, p. 14, 1881.
Tropaea artemis var. *aliena* Butler, Ann. and Mag. Nat., (5) IV, p. 355, 1879.
[*Tropaea*] *artemis* C. Oberthür, Études d'Entomologie, V, p. 39, 1880.
[*Tropaea*] *artemis* Kirby, Syn. Cat. Lep. Het., p. 765, 1892.

Imago.—One ♂, four ♀. Body of the same color as in *A. selene.* Palpi of the shape of those of *A. selene;* as well developed, being fully as large and long, projecting a little beyond the lower edge of the front. The tongue (the maxillæ being separate) extends slightly beyond the lower edge of the front, and as long as the lower edge of the front is wide. Maxillary palpi visible, darker red than the labial palpi, about one-third as long as the latter, and situated directly above them. Head behind the base of the antennæ red, but each side of the front is white. Apex of the fore wings not so acute as in *A. selene.*

Wings whitish pea green; the squamation very thin. No traces of a basal line; a single yellowish olive-green or brownish narrow faint line crosses both wings, in a straight course on the fore wings, but on the hinder pair the line is curved outwards opposite the ocellus; the line is, on the fore wings, situated half way between the ocellus and the outer edge of the wing, and in the hind wings nearer the outer edge. The costal band of the fore wings is reddish-madder but white on the extreme edge on the basal two-thirds of the wing. Ocellus of the ♂ fore wing narrow oval, of the same width as the discal cell, with a central narrow oval clear space; on the inside of this clear space yellow, succeeded by a very narrow pale-blue semicircle, and an outer narrow black semicircle; on the outer side of the central clear space, i. e., the discal veins, the ocellus is edged externally with greenish yellow. In ♀ the ocellus is smaller, not extending to either side of the discal cell; it is broader oval, and the blue semicircle is more distinct.

Ocelli of the hind wings large, round; a short, inner black semicircle and the black ring of which it forms a part interrupted at the origin of the discal veins, otherwise the colors are as in the ocelli of the fore wing. On the underside of the wings the ocelli are distinct, but a little duller in hue. They are white on the outer side, while in *A. selene* there is a pink-red semicircle edged externally with white, and there is more black brown on the inside of the ocelli of the fore wings. Fringe short, yellow, ochreous, or varying to white. Legs claret red. The tail of the ♀ is about one-half as long as that of the ♂, broad at the base and sharp at the end which is directed outwards; it varies in width and length.

Expanse of fore wing, ♂ 110 mm.; ♀ 120 mm.
Length of fore wing, ♂ 55 mm.; ♀ 60 mm.
Breadth of fore wing, ♂ 32 mm.; ♀ 39 mm.
Length of hind wing, ♂ 70 mm.; ♀ 66 mm.
Length to base of tail, ♂ 45 mm.; ♀ 56 mm.
Length of tail, ♂ 30 mm.; ♀ 10 mm.
Breadth of tail, ♂ 5 mm.

This species, though plainly congeneric with *A. selene,* differs remarkably from that species in the shorter broader fore wings and the very short tails; the difference between the sexes as regards these appendages being very marked. Although all authors have apparently unhesitatingly referred this species to *Tropaea,* we have seen that in the venation and also the head characters it is undoubtedly an *Actias;* moreover, the ocelli are not stalked as they are in *Tropaea.*

After an examination of the types of *gnoma, aliena,* and *dulcinea* of Mr. Butler in the British Museum, I am disposed to consider them as synonyms of *artemis*. Whether they are examples of local forms or races, or seasonal forms, or simply individual variations remains to be seen. [Dr. K. Jordan recognizes three subspecies: (1) *artemis* proper, from Amurland and Askold, with an ab. *caeca* Stgr., without ocelli; (2) *aliena* Butler, from Yezzo and the Main Island of Japan; (3) *xenia* Jordan, from Okinawa, Liu-kiu Island. Jordan gives the name ab. *flavicollis* to a specimen in which the wine-red color of the costal margin, collar, and legs is replaced by pale yellow.]

The tail of the ♀ *artemis* is variable in length and width. The extradiscal line is more or less distinct; in some ♂s and ♀s obsolete. There is a single line on the hind wings; in one ♀ are to be seen faint traces of a submarginal line.

In Butler's type of *dulcinea* there are no lines; the fringe is pale yellowish. Maassen also asserts, to quote Mr. Butler, that *dulcinea* is nothing else than *T. artemis* (p. 15). In his type of *gnoma* the fringe is white. Of his type of *aliena*, there are in the British Museum three ♂ and one ♀. I was unable to perceive any notable differences between these and the examples of normal *artemis* (*gnoma*). In one ♀ the extradiscal line is much nearer the outer edge than in the others. The tails of the ♂ are longer and the lines are heavier than in any *artemis*. The ocelli are a little larger and slightly rounder, but the coloration is the same. The fringe of the outer edge is yellow. The ♀s are the same as ♀ *artemis*, the ocelli being of the same size and shape, and the shape and length of the tail are the same.

Geographical distribution.—Pekin, China; Bureja Mountains (Bremer); Yokohama, Japan (Swinhoe); Tokio, Yokohama, Nikko (British Museum), Island of Askold, Siberia, near Vladivostock (Oberthür). Apparently ranges over northern China, Japan, and probably extends into Manchuria and southeastern Siberia.

"*Tropaea dulcinea.* ♂. Form of *T. gnoma*, excepting that the primaries are rather more elongated; most nearly allied to *T. artemis*, but differing in the absence of the white costal margin to the primaries, of the plum-colored band at the back of the head, and of the band on the under surface of the wings; the front wings are also decidedly longer; wings pale green, white at the base, and with white internal fringes; fringe of outer margin pale stramineous; ocelli small, oval, stramineous, with slender linear transparent pupil, and bounded internally by a white-edged black-curved litura; primaries with plum-colored costal border; body white, back of collar plum-colored; antennæ testaceous; expanse of wings, 5 inches 3 lines. Male, Tokei (*Fenton*)." [Dr. K. Jordan makes *dulcinea* a synonym of *gnoma*, which he considers a valid subspecies of *A. selene*. Staudinger's *mandschurica* is a link between *gnoma* and *ningpoana*, as it is now restricted by Jordan. It comes from the Amur and Ussuri districts.]

♂ *Tropaea gnoma.* "Allied to *T. artemis*, but smaller, of a bluer green; the veins brown instead of white; the fringe whitish, and the tails of the secondaries much narrower, longer, and more divergent. Expanse, 3 inches 9 lines. Yokohama (Jonas)." On comparing my ♂ specimen with Butler's figure, the veins are partly brown, and the fringe partly whitish; the tails are slightly longer and narrower than in Butler's figure. The discal spots are more distinct; they are represented by Butler as being very faint, with no dark semicirclar line, or any decided yellow, but he says nothing of these spots.

"*Tropaea aliena*, n. sp. (No. 323). ♂. Wings above pale yellowish green,[1] white at the base and along the abdominal border of secondaries; the usual small oval ocelli closing the discoidal cells; a slightly sinuous yellowish olivaceous discal stripe from costa of primaries to abdominal margin of secondaries; fringe pale sandy yellow; primaries with a second, irregular, oblique, subbasal, yellowish olivaceous stripe; costal border sordid plum color, densely irrorated in front with white scales, and bounded behind by a black stripe; body white; the head, collar, margins of the thorax, and abdomen slightly yellowish; a broad belt of dark plum color across the prothorax and tegulæ; antennæ bright testaceous; hind margin of eyes red. Wings

[1] Probably emerald green when fresh from the chrysalis, as there are traces of this color on the undersides of the wings.

below with an undulated discal line in place of the sinuous stripe of the upper surface; body below sordid white, palpi and legs rosy. Expanse of wings, 5 inches, 10 lines."

Mr. Butler remarks that this species most nearly agrees with the Mexican *T. dictynna*, but differs in the lack of the stalk of the ocellus of the fore wings, etc. But as we have seen, *dictynna*, even if a local race of *T. luna*, differs generically from *Tropaea* [*Actias*], and naturally enough Linnæus confounded these two forms, which do not appear to be separate.

ACTIAS SINENSIS Walker.

Tropaea sinensis Walker, Cat. Lep. Het. Br. Mus., VI, p. 1264, No. 7, 1855.
Actias sinensis Kirby, Syn. Cat. Lep. Het., I, p. 766, 1892.

Imago.—Two ♂. The following notes were made during an examination of Walker's types in the British Museum: It is a very distinct species, the ocellus of the fore wings being connected by a broad triangular brown stalk with the brown costa. It also has a regular deeply sinuous brown line common to both pairs of wings, situated half way between the ocellus and the outer edge of the wing.

The ocellus on the fore wing is large and centered with pink brown. The wings are much more ochreous yellow than usual. The inner line is distinct. A broad interrupted submarginal brownish band on the fore wings, which on the hind wings is nearer the outer edge; joining it at the base of the tail, which is purplish brown at the base and toward the middle.

Expanse of wings about 4 inches; Walker says 48 lines.

Geographical distribution.—Kiukiang, China, north of Thibet. Leech collection.

This is the only Asiatic species in which the ocellus of the fore wing is connected with the costa by a stalk.

ACTIAS FELICIS Oberthür.

Saturnia (*Tropaea*) *felicis* Oberthür, Etudes d'entomologie, livr., XX, p. 67, Pl. IX, fig. 61, 1896.

This very interesting Chinese species is, so to speak, a tailed *artemis*. Judging by the excellent figure, the fore wings are short and broad, the apex very obtuse; the outer edge full and convex; while the small ocelli are remote from the costa and not stalked. The hind wings are prolonged into a tail, which is considerably wider at the base than near the rather acute tip, and is a little more than half as long as the main portion of the wing. The ocelli are considerably larger than in the fore wings. There is an extradiscal scalloped dusky line common to both wings. Compared with the ♂ *artemis* the tails are considerably longer, but similarly pointed at the tip; the outer edge of the fore wings is much fuller, more convex. The ocelli of the fore wings are a little rounder, and those of the hind wings less so than in *artemis*.

Length of fore wing, 45 mm.
Breadth of fore wing, 25 mm.
Length of hind wing, 65 mm.
Breadth of hind wing, 23 mm.
Length of tail, 30 mm.

Oberthür describes it as pale sea green, with the costa and collar violet brown; fringe yellowish; a grayish extradiscal line; ocelli a little elongated and with a black internal crescent and a central hyaline part surrounded by a rose-white nappy pad.

Geographical distribution.—Siao-Loû.

Another unnamed species inhabits Leon-Fang, China. The tails of the ♂ are very long and roseate; the wings are green with the edge broadly washed with rose color; the body is lemon yellow, with the collar violet gray; the costa of the fore wings violaceous, scattered over with white scales. There is no white part between the collar and the head. A ♀ from the same country, but in which the edge of the wing is not roseate; only the very long tails are rosy in the middle and yellowish at the end.

TROPAEA Hübner.

[*Tropaea* Hübner, Verz. bek. Schmett. (1822?), p. 152.]

[*Tropaea*] *luna* differs [from *Actias*] in the shorter, broader, wings; antennæ pectinated to tip; palpi shorter; front with large scales; fore wing with outer edge only slightly longer than inner; tails *inclined* to be longer than in *Actias;* lines faint. [From some notes which were never completed.]

TROPAEA LUNA (Linné).

Plate XV; XVI; XVII, fig. 1; L, figs, 3, 4; LXV, figs. 1 (*luna*), 2 (*azteca*), 3 (*dictynna*); LXXIV, fig. 3.

[*Bombyx luna* Linné, Syst. Nat., Ed. X, I (1758), p. 496.]

Imago.—Eight ♂, eight ♀. Head and body white or pale yellowish; at the base of the antennæ and on the extreme side of the head pink-red-brown. A continuous costal deep reddish-brown or lilac band on the fore wings passing across the front of the thorax, behind the white collar. Fore wings somewhat falcate, varying a little in this respect; uniformly delicate pale pea green, varying to pale yellowish or white. Very faint traces of an extradiscal line parallel with the outer margin, which in most cases (in 7 out of 12) is wanting. This line is divided into about seven long slight scallops, one in each cell.

Ocellus connected by an oblique brown stalk with the reddish brown costal band; this stalk follows the common stalk of veins II_3 and II_4, arising from the main vein II, and is about as long as the ocellus is wide. (In two ♀ it fails to reach the ocellus, ending at the origin of veins II_3 and II_4; sometimes it grows slightly wider toward the ocellus, but more frequently narrows toward the ocellus.) It is brown at base; the black extension of the black inner edge of the ocellus extends forward to the base of vein II_4; the pink ring of the ocellus unites and sends a pink-red dash into the middle of the stalk, while a shorter line arises from the yellow ring of the ocellus. The ocellus itself is rounded oval, and, as in all others of the group (Actiasiæ), it extends from vein II to IV (cubitus); it is constant in size and coloration; the vitreous center is narrow oval, varying in width, but at the most not more than three times as long as wide, and situated on the distal side of the discal vein, which is not visible; it is edged externally with white. A narrow pink-red ring, which is narrower externally than on the inside, which is situated next to the vitreous area. Beyond on the outer side is a broad yellow semicircle which extends forward along the outside of the distal end of the stalk to the origin of vein II_3, and this semicircle is edged externally with either white or brown, the latter edging containing on the outside a few white scales. The inside half of the ocellus is formed of four bands; next to the innermost red band is a yellow one, then a very narrow steel blue curved line situated within the limits of the rather wide black semicircle. (In all the group the discal vein is on the inside of the vitreous spot.) *T. luna* has the most specialized ocellus in the group when we add also the stalk.

Ocellus of the hind wing larger than that of the fore wings and nearly perfectly orbicular; the vitreous area slightly larger than in the fore wings; the white and yellow semicircles much wider than in the fore wings; the outer linear black line is more distinct, also edged externally with whitish scales; the inner side as in the fore wings, but the black portion is wider.

The hind wings are invariably scalloped (not so in *Graellsia isabellæ* and *Tropaea selene*, though in some examples they are). The tails are wide, of the same width throughout, not being contracted in width in the middle, and the tip is well rounded.

Fore and hind wings of exactly the same delicate pea green. The outer edge of the fore wings is pink red (winter form), this hue extending from the II_2 cell to the second IV cell, the red border being narrowly edged with yellow scales; apical region straw yellow. In some examples the yellow scales of the fringe are wanting. In others (summer form) the border and fringe is yellow. Hind wings yellow at the apex, pink red from vein II_4 to base of the "tail." The latter is concolorous with the wing, with no tendency to pink or brown (as is seen in *Tropaea* and *Argema*). In both wings there is a faint delicate turquoise-green shade on the edge of the wings.

Under side of the wings considerably paler than above; ocelli much less distinct, the stalk obsolete; there is no yellow semicircle on the outside, the yellow being replaced by white scales. The costal region of the fore wings is white, the extreme edge pink red or all pale pink.

Legs of a rich reddish brown; the hair-like scales on the outside white. Abdomen and thorax white, in some specimens tinged with yellow.

Expanse of the fore wings, ♂ 81–128 mm.; length of wing, ♂ 42–60 mm.

Expanse of the fore wings, ♀ 80–140 mm.; length of wing, ♀ 41–65 mm.

Mr. W. L. W. Field informs me of the very interesting fact that directly after emergence examples of *T. luna* reared in Milton, Mass., as soon as the wings are expanded after emergence from the pupa have at first distinct extradiscal lines, which disappear within an hour. The phylogenetical bearings of this phenomenon will be noted in another place.

Variations.—Besides the ordinary or normal pale pea-green color, others are whitish.[1] One ♀ from Louisiana is whitish green with wide and deep pink borders; one ♂ from Florida has a reddish border, which, however, is much paler and narrower than in the Louisiana example. Of six specimens bred by Mr. H. L. Clark in Rhode Island, two are whitish green in hue and four are yellowish green. There seems to be a tendency in the New England individuals to have yellow borders, and to be paler throughout; Maine ones are paler than more southern ones. Specimens raised in Texas in 1870 differ from New England examples by the broad reddish pink border of both wings, by the larger ocelli, while the markings are more distinct, the ocelli of the fore wings being more distinct, especially on the outer edge. These notes were written during an examination of the collection in the Cambridge Museum.

Seasonal dimorphism.—As is well known, some individuals have a reddish and others yellow edges and fringes to the wings. Mr. L. H. Joutel has explained to me the cause of this, i. e., that the pinkish-red bordered individuals are the winter form, and the yellow-edged ones the summer form. This of course applies only to regions where *T. luna* is double-brooded. In northern New England we should expect, as there is but a single brood, the moths emerging in the early summer from pupæ which have wintered over, that the effect of cold on the wings would be to produce red borders, and not yellow. The difference between the winter and summer forms may be brought out by descriptions of two males, one a winter and the other a summer male, kindly given me by Mr. L. H. Joutel, who informs me that they were bred at about the same time (i. e., year) and fed on hickory leaves. From one cocoon of the lot that yielded the individual of the summer brood here described the moth emerged a year after the others. The male of the winter brood has decidedly falcate fore wings and is pea green, but with no yellow shade; the middle of the outer edge of the fore wing is pink red, but on the apical region and along the inner angle the red is replaced as usual by yellow. The ocellus is round and rather large (4 by 4½ mm. wide); the stalk is well developed.

The hind wings are unusually scalloped, the fringe yellow on the scalloped or anterior portion, the edge behind red, this hue extending along the outer edge of the base of the tail. The apex of the hind wings is unusually sharp. The tails are very long and narrow. Ocellus of hind wings a little larger (4½ by 5 mm.) than on the fore wings, and round.

Length of fore wing, 50 mm.
Breadth of fore wing, 27½ mm.
Length of hind wing, 70 mm.
Breadth of hind wing, 32 mm.
Length of tail, 38 mm.
Breadth of tail, 5 mm.

The male of the summer brood (which emerged a year after birth) has broad scarcely falcate wings, thus assuming the shape of the ♀. The apex of the hind wings is very slightly scalloped, and the tails are unusually short and broad. The wings are pale green, almost frosted over with white, and the ocelli and costal bands are paler than in the winter form. The ocellus of the fore wing is much smaller (3 by 4½ mm.) than in the winter form, with no red semicircle on the outer edge of the white crescent (as there is in the winter form). The discal end of the stalk is partly obsolete, the ocellus tending to be partly free from the stem.

[1] [I noted in the U. S. National Museum that yellow-green specimens were males, light bluish green females. Dr. W. T. M. Forbes assures me that this is a regular sexual difference.]

The edge of the hind wings is yellow, but on the inner angle the fringe is whitish. Ocellus not so long as wide (4½ by 5 mm.), with no traces of red scales either inside or outside of the discal veins.

The under side of both pairs of wings whitish, and the ocelli of both pairs of wings are much smaller and paler than in the winter form, those of the hind wings being no larger than those of the fore wings.

Length of fore wings, 50 mm.
Breadth of fore wings, 31 mm.
Length of hind wing, 70 mm.
Breadth of hind wing, 33 mm.
Length of tail, 28 mm.
Breadth of tail, 7 mm.

In neither of the two forms are there any traces of an extradiscal line.

Climatic varieties or races.—While *T. luna* from Maine to Texas and Florida and throughout the United States north of Mexico offers so far as yet known no local or geographic races, the case appears to be different in Mexico and Central America. There, on the southern outskirts of its range, it seems to have been affected by climatic agencies, and to have varied locally in different directions and to have been differentiated into perhaps three local races or varieties, i. e., *T. luna* var. 1, *dictynna;* 2, *azteca;* and 3 *truncatipennis.*

(1) *Tropaea dictynna* WALKER, Cat. Lep. Het. Br. Mus., VI, p. 1264, n. 8 (1855).

Walker's description gives no locality for his specimen, which was contained in Mr. Saunders's collection. He remarks:

"This species much resembles *T. luna,* but may be distinguished by the band on the wings, by the not empurpled exterior border, by the fore wings, which have a less oblique and more straight exterior border, and by the hind wings, which have shorter tails."

A ♀ in the Oxford Museum, which agrees with Walker's description, was examined by me, thanks to the courtesy of the attendant in charge. In this specimen the fore wings are broad and obtuse at the apex; there is a pale greenish-brown distinct extradiscal line, situated a little more than half way from the base to the apex of the fore wings, being nearer the outer edge of the wing than to the ocellus, and the line reappears on the hind wing.[1] The ocelli are quite as in *T. luna* and those of the fore wings are nearly separated from their stalk. The edge of the wings is ochreous yellow. The tails are longer than in *T. luna* (Walker says the tails are shorter). The hind wings are a little scalloped. The impression made upon me was that this form is not distinct from *T. luna.* I also examined with more care and deliberation the ♂, labelled *T. dictynna* in the British Museum, from Orizaba, Mexico, "at or near the volcano," with the following results:

It differs from four ♂ and five ♀ of *T. luna,* in the same drawer, in the distinct extradiscal brown band, which is wide and crosses the fore wings, not quite reaching either the costa or the hind edge. The shape of the wings and the length of the tails as in *T. luna.* Outer edge of both wings yellow and pale brown, as in *T. luna.* In the hind wings the outer edge is not so much scalloped as in most of the examples of *T. luna.* The wings are ochreous green, rather more so than in the examples of *T. luna,* and the squamation is rougher. Ocellus of the fore wing as in *T. luna,* but there is less white next to the vitreous center, but more red, otherwise the shape and coloration of the ocellus is the same. In the ocellus of the hind wings the yellow ring is deeper ochreous than in some *T. luna,* but of the same hue as in some others; the red ring is distinct. The ocelli in fact show no varietal differences. The moth is not quite so large as the largest *T. luna.*

At the time of examination I concluded that *T. dictynna* is hardly a climatic variety of *luna.*

That *dictynna* is only a banded form of *luna,* and liable to occur anywhere, is probable from the fact that the late Mr. S. L. Elliot has bred it in Brooklyn on the walnut, having raised

[1] Mr. W. L. W. Field informs me that in examples bred by him at Milton, Mass., the bands appear after emergence from the cocoon as soon as the wings expand, but that after about one hour they disappear.

from 400 to 500 of this species. He once remarked to me that the tail in the banded individuals is on the whole inclined to be shorter than in the unstriped individuals. On the other hand, he said, the pale thin green ones bred on leaves of the sweet gum (*Liquidambar*) have very long tails, no bands, and the fore wings edged with reddish-pink. Are there food varieties?

Mr. Field informs me that in examples bred by him at Milton, Mass., bands appear after emergence from the cocoon as soon as the wings expand, but that after about an hour they disappear.

[The following was evidently written by Dr. Packard at a different time:]

Mr. A. G. Butler, Annals and Mag. Nat. Hist., fifth series, IV, p. 356, 1879, remarks as follows concerning this form:

"Linnæus evidently confounded *T. dictynna* with *T. luna;* for although in the tenth edition of his 'Systema,' he quoted Catesby's figure of the North American insect and Petiver's representations of the same species as illustrations to his brief diagnosis, yet for the fuller description given in the 'Museum of Ulrica,' he quoted Clerck's 'Icones' first of all; and the figure in the latter certainly represents the Mexican species, inasmuch as the wings are crossed by a well-defined discal stripe. It is probable that both descriptions are taken from the northern type."

It would seem, since *dictynna* is scarcely a local race of *luna*, much less a "Mexican species," that Linné did not confuse the two forms, for individuals with wings crossed by a well-defined discal stripe, are liable to occur anywhere, north or south, or in Central America.[1]

(2) *Tropaea azteca* Packard, Guide to Study of Insects, p. 298 (1869).

[The original description is as follows:]

"In the museum of the Peabody Academy is a closely allied and undescribed species from the west coast of Guatemala, which we would call *Actias azteca*. It differs from *A. luna* on its much smaller size, expanding only 3½ inches, and in the shorter fore wings, the apex being much rounded and with shorter veins, while the 'tails' on the hind wings are only half so long as those of *A. luna*. It also differs in having the origin of the first subcostal venule much nearer the discal spot than in *A. luna*, being very near that of the second subcostal venule. It is whitish green, with markings not essentially differing from those of *A. luna*."

Originally described as a new and distinct species, I have again examined the single ♀ type specimen, which has been discovered in the collection of the Cambridge Museum, presented to that museum by the Peabody Academy of Science, Salem, Mass.

It was described as quoted above as differing from *A. luna* in its much smaller size, and in the shorter fore wings, the apex being much rounded, "while the 'tails' on the hind wings are only half as long as those of *A. luna*." It is whitish green, with markings not essentially differing from those of *A. luna*. What we then said regarding the supposed difference in the venation does not now seem of much weight, as there do not seem to be any perceptible differences.

A reexamination of the type has resulted in the following observations: The type of *azteca* is similar in shape of wings and in the discal spots with their stalk to the summer form of an ordinary *T. luna* from New York, but it has decidedly shorter tails than any specimen I have yet seen, while the apex of the fore wings is much more rounded. There are no traces of a submarginal line, as seen in var. *dictynna*. The discal ocellus of the fore wings is small and narrow, in the center is a narrow lanceolate oval clear space, edged within with a pink semicircle, succeeded by a broader black crescentiform semicircle, containing a linear strip of pale blue scales. It measures 4 by 3 mm. The stalk is well developed. The blue line in the discal ocellus of the hind wings is not distinct; the spot measures 4½ by 4½ mm.

Expanse of the fore wings, ♀ 90 mm.
Length of a single fore wing, ♀ 45 mm.
Breadth of a single fore wing, ♀ 26 mm.

[1] [Dr. W. T. M. Forbes informs me that all the specimens of *T. luna* from southern Florida in the American Museum of Natural History are of the *dictynna* type, and on the average quite different from the northern form. They have the banded wings and shorter tails, but differ from Walker's account of *dictynna* in having more crimson color than the ordinary *luna*. This last character may be seasonal.]

Length of a hind wing, ♀ 52 mm., including the tail, which is 21 mm. long and 5 mm. wide in the middle.

Breadth of hind wing, ♀ 24 mm.

Geographical distribution.—This form was collected at Polvon, occidental department, West Nicaragua, near the Bay of Realejo, but inland between Corinto and Leon, near Corcuera, by John A. McNiel.

Whether this is even a local race peculiar to Nicaragua or not remains to be seen, when more specimens are discovered; the tails vary greatly in length, though it is noteworthy that both *truncatipennis* and *azteca* occur in Central America, forms in which there is so much divergence as regards the length of tail.

(3) *Tropaea truncatipennis* SONTHONNAX [Lep. Soie, II (1903), p. 19, Pl. VII, Jalapa]; Pl. L, fig. 2.

One ♂, one ♀. This form differs in the smaller ocelli of both pairs of wings; the ocelli of the fore wings are so small that they do not reach vein IV. Beneath, the ocelli are noticeably smaller than in *luna*. The shape of the wings is also different from *luna* of Texas northward, the fore wings being a third smaller and rounder, the hind wings being less rounded and more elliptical. This is the chief and only tangible difference between the two forms. The stalk, its size, shape, and coloration is just as in *T. luna*. The general hue is the usual delicate pale pea-green shade, as seen in most of the northern specimens. The outer edge of the wings of both pairs is deep reddish pink. The hind wings are less scalloped than in the normal *T. luna*, and the fore wings tend to be slightly more falcate. There is, as in most of the examples of *T. luna*, no trace of an extradiscal band or line or any other markings. It is of the same size, the same expanse of wings, and the legs and body as just as in *T. luna*.

Truncatipennis:

Expanse of fore wings, ♂ 123 mm.; ♀ 126 mm.
Length of fore wings, ♂ 60 mm.; ♀ 63 mm.
Length of hind wing, including tail, 86 mm.
Length from discal vein to tip of tail, ♂ ♀ 62–64 mm.
Ocellus of fore wing, 4 by 4.3 mm.
Ocellus of hind wing, 4.3 by 5.5 mm.

Luna:

Expanse of fore wings, ♂ 125 mm.
Length of fore wings, ♂ 60 mm.
Length of hind wing, including tail, ♂ 85 mm.
Length from discal vein to tip of tail, ♂ 64 mm.
Ocellus of fore wing, ♂ 5 to 5.2 by 4.5.
Ocellus of hind wing, ♂ 5.6 by 5.1.

If these characters hold good in a larger number of specimens, *truncatipennis* may safely be regarded as a climatic variety of *T. luna*.

[An apparently more recent note on *T. truncatipennis*, based on a female in the Godman-Salvin collection (British Museum), from Jalapa, indicates that this is probably a valid species.]

Fore wings falcate, outer edge curved in, but no more so than in some ♀ *luna*, which varies much, some being falcate and others with outer edge not excavated at all. Hind wings pointed at apex and outer edge not full, but straight and not scalloped. Outer edge of both wings broadly margined with reddish brown (magenta?), but two of *luna* as much so. Tails a little longer than in *luna;* considerably longer than breadth of the hind wing. Third median vein arises nearer base of wing than in *luna*. Venation of fore wing as in *luna*. Ocelli of fore wing as in some *luna*, well pronounced, red, yellow, blue semicircle and black. Ocellus of hind wing not so large as in some *luna*, but well marked; black is heavy, as is red, the yellow outer portion is pale green, less ochreous than in Mexican (Orizaba) specimen. Outer edge and apex of hind wing is less scalloped and more acute than in any *luna*. All four ocelli beneath are larger than in Orizaba *luna* and United States *luna*. It seems quite distinct from the Mexican

♂ *dictynna*. Sir George Hampson thinks it is a good species; as the larva differs from *luna* (Schaus), it may be regarded as a distinct species.[1]

A new climatic race (?) *bred in Europe.—Tropaea luna*, var. *bollii* (Wagner); *Saturnia bolli* Wagner, Tijdschr. voor Entom., 1875–76, XIX, p. xcvii–xcviii; Isis, etc.

The ♂ specimen in the Cambridge Museum reared in Switzerland differs from the Texan normal *luna* ♂ in the antennæ being very narrow, but little more than half as wide as usual; the submarginal brownish line on the fore wings is distinct; ocellus small, its outer edge indistinct; that of hind wing is much smaller than in natives of Texas, about one-fourth less in diameter, and the pink line is wanting in the ocelli of the hinder wings. The tail is rather short, and the moth is a little smaller than other Texan *luna*. The edge of both wings is yellowish as in the summer form of *T. luna*.

[Other varieties of *T. luna* have been described as follows:

(1) Variety *rossi* (Ross). Male pure white, expanding 3½ inches; female white with a light yellowish tinge. Near Toronto, Canada. (Classif. Cat. Lep. Canada, 1872.)

(2) Variety *rubromarginata* W. T. Davis. A spring form in New York State, having the costa red or reddish, and the outer margin of the wings "of a reddish or scarlet hue." (Psyche, June, 1912, p. 91.)][2]

Life history of Tropæa luna (Linné).

The eggs were received from Mr. James Angus.

Egg.—Oval-cylindrical, somewhat flattened. The shell is thick and tough, dark brown externally, but in places the brown is worn off, leaving a dull, sordid chalky whitish surface; the inside of the shell slightly bluish gray. The surface of the shell is seen under a Tolles triplet to be rough and finely granulated, and under a half-inch objective, the surface is seen to be closely granulated, the pits between the granulations being often confluent; rarely the raised bosses appear to be polygonal. Length 2.1 mm., breadth 1.8 mm. Eggs laid at Providence, June 14; hatched June 22–25.

Larva.—Stage I. Length 6–8 mm. Some were observed hatching out between 11 and 1 o'clock p. m., June 15. Before entirely breaking out of the eggshell the tubercles on the anterior segments become erect, and the hairs radiate from them, but behind along the third thoracic and abdominal segments the tubercles were seen to be soft and flattened or appressed to the body and adhering in flaccid bundles. In *S. cecropia*, on the other hand, all the tubercles and bristles are flabby for perhaps half an hour after the creature frees itself from the egg.

One was seen to emerge at 1.15 p. m., and by 1.25 p. m. all the tubercles had become filled out and erect, with stiff, radiating bristles.[3] On hatching, the body is entirely green, except the bands on the head. Some larvæ on hatching are (*a*) entirely yellowish green, while the dorsal hairs are darkish, and the head is twice banded. Others (*b*) have *a very broad blackish lateral band*, inclosing one lateral row of greenish tubercles, the band ending on the eighth abdominal segment, and nearly meeting above. The prothoracic segment is dark on the hinder edge, and the second and third thoracic and first abdominal segments are entirely dark above.

The following description is drawn up from individuals which had been hatched for about a week (May 24–26), and were near the end of this stage. The body was larger, fuller, and less tapering posteriorly than at first. The head is small, about half as wide as the body, rounded, and at rest can be retracted within the prothoracic segment. There is *a transverse dark*

[1] [The U. S. National Museum has eight specimens of *T. truncatipennis;* the localities are Jalapa, Guadalajara, and Orizaba. They all have the outer margins of the wings narrowly red. The costo-apical angle of the secondaries seems normally much more acute than in *luna*, and from here to the base of the tail the margin is straight, whereas it is distinctly convex and wavy in *luna*. None shows any traces of *dictynna* bands. The sexes seem not to differ in color.]

[2] [Dr. W. T. M. Forbes suggests that the account of *rossi* could apply to newly emerged examples of typical *luna*, with the descriptions of the sexes reversed. Excellent specimens of *rubromarginata* are in the National Museum, and also a more extreme ab. *rubrosuffusa*, of which a male was taken at Washington, D. C. (Knab). This is like *rubromarginata*, but has the red of outer wing margins, especially of the hind wings, broader and suffused, on hind wings at base of tails fully 5 mm. broad, and this is bordered within by a pallid, almost bluish suffusion. The ocelli on the hind wings are unusually large.]

[3] It is evident that before and at the point of hatching the setæ or bristles are filled with blood, which distends them. While thus distended, the fluid may ooze out of the ends, and thus they may be called glandular hairs. In those which are full and bulbous at the end, the fluid may be retained through stage I, and in rare cases through the second or even the third stage.

brown band in front just below the vertex, making two scallops, and ending on the sides; on each side (below) of the front edge of the clypeus is a dark spot around the base of the antennæ, which sometimes sends *a short line inward,* as in Mr. Bridgham's figure.

The body is thick, full, cylindrical, each segment, except the prothoracic and last two abdominal ones, with six thick, smooth conical tubercles, those on the sides above the spiracles smaller than those below, and about one-half the size of the dorsal ones, and bearing fewer bristles than the others. Prothoracic segment with only four tubercles, the two dorsal ones low, flattened, and small, with about 14 radiating bristles. The lateral tubercles are like those of the other segments; the rest of the dorsal tubercles are large, full, nearly touching at their base, and bearing about 8 to 10 bristles, which are one-half to one-third longer than the tubercles themselves; they radiate and are dark purplish, pale at base, those on the back darker than those arising from the lateral tubercles. *The second and third thoracic dorsal tubercles are slightly larger than the abdominal ones.* Each of the dorsal abdominal tubercles bears about six bristles. The body is delicate pea-green, nearly like the under side of the Carya leaf on which they feed. The tubercles, especially the dorsal ones, are tinged with faint straw or lemon yellow, while the lateral supra-spiracular tubercles are greenish, scarcely tinged with yellow.

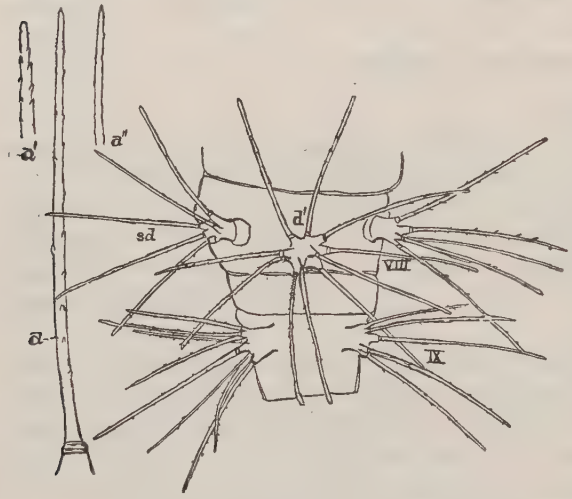


Fig. 18.—*Tropæa luna;* larva, first stage.

The bristles are longer in proportion to the tubercle than in the larva of *C. promethea;* most of them are three times and some four to five times as long as the tubercle. The bristles are sparingly and minutely barbed, tapering acutely, but they are clear, and perhaps glandular.

The median dorsal tubercle on the eighth uromere shows traces of its double origin, but they are not so marked as in *C. promethea* and *T. polyphemus,* but more so than in *Platysamia cecropia.* It is much broader than long at base, and on the tip bears five setæ on each side. The ninth uromere bears four tubercles of equal size, which are large and well developed, the lateral ones scarcely smaller than the dorsal ones. The suranal plate is broad and short, more so than in *T. polyphemus,* not tubercled, but bearing two tufts of bristles which are but a little shorter than those arising from the lateral tubercles of the rest of the body.

The anal legs are large and squarish, as in the group generally; all the legs, both thoracic and abdominal, are pale green. The abdominal legs bear each 20 crochets. The three tenant hairs of the thoracic feet are rather longer than usual. The spiracles are slightly chitinous, not colored.

The shape of the double dorsal tubercle on the eighth abdominal segment is shown at figure 18, *d'; sd,* the subdorsal ones; *a,* a seta much enlarged, which, unlike *T. polyphemus,* is finely and minutely barbed; *a', a''*, ends of other setæ.

Stage II: Molted May 26, in the daytime. Length at first 9 mm., afterwards 10 mm. In one larva all the tubercles are of the same yellowish hue; in the other, those of the second and third thoracic segments are brownish at the tip, thus greatly contrasting with the others. In another larva the median dorsal tubercle on the eighth uromere is also colored in the same way. The head in one is all green, not yet banded with brown; but in another the head is partly banded, i. e., in place of the two-scalloped band are two separate short scallops.

The tubercles are now *higher than before,* and rough with slender conical warts which give origin to the setæ. The prothoracic tubercles are now *longer than before,* and all four are deep amber-yellow at the end, the setæ being black; two out of the five spines of the second and third thoracic segments are dark brown at and near the ends and give rise to black bristles, rendering

them very conspicuous; they are a little larger and higher than those on the abdomen, and bear about twice as many bristles; eight in all, all of which are black, while on the yellow tipped tubercles of the abdominal segments there are about five bristles, one of them minute; two of the five are black, the others pale. The two lateral rows of tubercles are, as before, with pale bristles.

The median dorsal tubercle on the eighth uromere is not quite so dark as those on the second and third thoracic segments, and some of the latter are scarcely darker than the other abdominal ones. The spiracles are of the same pale color as before. The suranal plate still bears the two terminal tubercles, as before. The thoracic legs are now darker than before.

In this stage the larvæ sometimes assume a sphinx-like attitude.

Stage III: Molted June 1. (I am not sure that it was the same larva; one molted May 31. Described three days after molting.) Length 13 and finally 15 mm. The head is either banded as before, or all green, only the ocelli being black. The body is now thick, though differing very slightly from the preceding stage. The four prothoracic, the two dorsal second and third thoracic tubercles, and the single median dorsal tubercle on the eighth uromere are either deep crimson red at the end, or much paler, and in the largest one yellowish, the tips of these tubercles varying a good deal in color; *these tubercles are now nearly twice as long and thick as those on abdominal segments 1 to 7 and 9.* The tubercles of the two lateral rows are of the same size as before; those of the upper (supraspiracular) row are still green and small; those below, situated on the lateral ridge, are salmon-colored and provided with black setæ, like those arising from the dorsal tubercles; near, and on the base of and between the tubercles, are *white, delicate clavate hairs* (glandular?) which are not observable in the preceding stage; they are mostly confined to the abdominal, few, only one or two, on the thoracic region.

The thoracic legs are dark brown, pale at the tip; the abdominal legs except the anal pair, are green, with a transverse lilac line near the ends; beyond yellowish, while the plantæ are tinged with lilac. There is as yet no lilac tinge on the edge of the suranal plate.

Stage IV: (Belonging to a later different brood; described July 24.) Length 23 mm. The head now pea-green, *not banded in front,* nearly as wide as the body; well rounded, and of the same shape as in *T. polyphemus;* it is of a deeper pea-green than the body, which is in general, especially on the dorsal side, paler than in *T. polyphemus.* The labrum and jaws are pale. There is a chestnut-colored ocellar patch.

The segments are now *quite convex,* swollen under the base of the tubercles, the second and third thoracic segments being fuller and more angular than the uromeres; they are a little more so than in *Telea polyphemus.*

The four dorsal tubercles of the second and third thoracic segments (two each) are larger than the abdominal ones, and *are tipped with dark carmine* at the end, and each, besides one or two short setæ, bears a long black slender hair, about as long as the body is thick; the corresponding hairs on the abdominal tubercles being about one-third as long. There are four well-developed prothoracic tubercles, the dorsal ones larger, more rounded, and prominent than in *T. polyphemus,* and also bearing besides three or four small, short pale hairs, and a black very long one. The prothoracic tubercles are *deep rosy pink,* not coral-red. The lateral ones on the same segment are nearly twice as large as those behind in the same series, and all on the body are rosy pink or "crushed strawberry" color. The lateral infraspiracular ridge along the abdominal segments is distinctly lemon-yellow. The spiracles are faint reddish green, quite inconspicuous. The thoracic legs are reddish. The middle abdominal legs are green above, below is a narrow distinct black stripe, the end yellow, while the planta is livid flesh color; the anal legs with an anterior oblique yellow band, and a black spot corresponding to the black stripe, with black hairs above, as on the middle legs. The suranal plate is faintly edged with yellow.

The larva in this stage differs from *T. polyphemus* of the same age in the *green* head, the distinct lateral yellow stripe below the spiracles, which are *green,* and not readily seen. The six dorsal thoracic tubercles are distinctly *larger and more prominent* than the abdominal ones, and they each bear a single very long slender black hair, besides one or two short ones; this is a

good generic character, separating it at once from *T. polyphemus*, and the suranal plate is not edged with purple, but with faint yellow.

When fully fed,[1] its length is 65 mm. Maine, August 20. The head is green, of a different hue from the body, more like Paris green. The body is large, heavy, plump, and thick, much as in *T. polyphemus*, and the tubercles are pinkish red, or crushed strawberry. The suranal plate is edged with yellow in front, but the surface is coarsely granulated, and in color dull amber; there is a similar long narrow patch on the side of the anal legs, bordered above with black and straw-yellow. The spiracles are green with the edge of the linear opening ochreous. The yellow lateral line is obscure. The body is still provided with white hairs, not arising from tubercles. The body is pea-green, dorsally slightly tinged with ruddy.

Recapitulation of the more salient ontogenetic features.

A. Congenital features.

1. Setæ tapering to a point, not bulbous, and finely barbed. Stage I. Most of them are three or four times as long as the tubercles.
2. Some larvæ in stage I with a very broad lateral dark band along the side of the body, some without it; no transverse stripes present, but the head in front is twice banded with dark brown.
3. The 2d and 3d dorsal thoracic tubercles differentiated in stage I, being slightly larger than the abdominal ones.
4. On the suranal plate are two rudimentary tubercles, each bearing a tuft of bristles.
5. The dorsal median tubercle on uromere 8 does not show such marked traces of its double origin as stage I of *C. promethea*, or *T. polyphemus*, but it is more duplex than in *S. cecropia*.

B. Evolution of later Adaptational Characters.

1. Dorsal tubercles in stage II higher than before.
2. The lateral dark band disappears in stage II.
3. In stage III the dorsal thoracic tubercles become nearly twice as long and thick as the abdominal ones.
4. The head is not banded in stage IV.
5. The tubercles brightest (pink or dark carmine) and most conspicuous in the last stage.
6. A distinct infraspiracular yellow line in stage IV, and the suranal plate and anal legs lined with yellow, and the surface of the suranal plate and sides of the anal legs amber.

[The records of the United States Department of Agriculture indicate the occurrence of *T. luna* in the following localities: New Hampshire (Derry, Center Sandwich); Vermont (Norwich); New York (Brooklyn); New Jersey (Hackensack, Allendale); Pennsylvania (Spring Creek, Lancaster, Tamaqua); Ohio (Franklin); Maryland (Pearson); Virginia (Carlin Springs); North Carolina (High Point, Wilkesboro, Raleigh); Kentucky (Louisville); Illinois (Douglas); Arkansas (Orlando); Indiana (Rockville); Tennessee (Henry); Louisiana (New Orleans, Wilsons Point); Mississippi (Craig); Florida (Astor, Madison, Kissimmee). I picked up a fragmentary specimen from the seabeach at Woods Hole, Mass.

The following are from the records of the Bureau of Entomology:

V. T. Chambers counted 22 Tachina eggs on a single *T. luna* larva; this larva produced a moth, notwithstanding. (C. V. Riley.)

A. H. Mundt, of Fairbury, Ill., sent eggs of *T. luna* which were infested with what was supposed to be a species of *Pteromalus*. (T. Pergande).]

[Prof. M. H. Swenk reports that *T. luna* "is common in eastern Nebraska wherever walnuts occur. We have specimens from Lincoln, Nebraska City, Weeping Water, Beatrice, etc." (litt July, 1912).]

"Not uncommon from here [Ottawa] westward throughout Ontario, and up to Winnipeg in Manitoba. I have seen two specimens in Manitoba, but doubt if it extends farther than the wooded country on the east of that Province. There are no maples, butternuts, hickories, or walnuts native in Manitoba." (J. Fletcher, litt 1900.)

[1] Dyar states that there are but four stages.

ANTHERÆA Hübner.

[*Antheræa* HÜBNER, Verz. bek. Schmett. (1822?), p. 152. Type, according to Kirby, *A. mylitta* Drury.]

[Rothschild, Nov. Zool., II (1895), pp. 43–44, arranges the species thus:]

1. *A. assamensis* (Helf.)
2. *A. helferi* Moore. [Darjiling.]
3. *A. perrotteti* (Guér.). [Pondicherry.]
4. *A. paphia* (Linn.). [Java, Amboina.][1]
5. *A. andamana* Moore. [Andaman Islands.]
6. *A. mylitta* (Drury). [India.]
   ab. *cingalesa* Moore.
7. *A. semperi* Feld. [Luzon, P. I.]
8. *A. pernyi* (Guér.). [North China.]
   subsp. *roylei* Moore. [Darjiling.]
   ab. *confuci* Moore. [Shanghai.]
   ab. *shervillei* Moore.
9. *A. larissa* (Westw.). [Java.]
10. *A. frithii* Moore. [Darjiling.]
    ab. *fraterna* Moore. [Himalayas.]
11. *A. billitonensis* Moore. [Billiton Island.]
12. *A. yama-mai* (Guér.). [Japan.]
    [Rothschild states that no two specimens are alike, and treats the following variations or aberrations as synonyms: *sergestus* (Westw.), *morosa* Butl. *hazina* Butl., *fentoni* Butl., *calida* Butl.]
13. *A. sciron* (Westw.). [Waigiou.]
14. *A. pristina* Walk. [Papua.]

[Jordan (1910) described *A. castanea* from Assam. Many other species have been described by Moore (1892), Swinhoe (1892, 1893), Hampson (1892), and Lucas.]

[Watson, Wild Silk Moths of the World (Manchester, 1912), has given colored figures of *A. yama-mai* (Guér.), *A. compta* Rothschild, *A. mylitta* (Drury), *A. pernyi* (Guér.), and *A. andamana* Moore. He also figures the cocoons of all of these except *compta*. *A. andamana* is a curious plum-colored species, the wings with the ocelli relatively small, the anterior wings of the male very strongly falcate.]

ANTHERÆA YAMA-MAI Guérin.

Plates XXVI, figs. 2–5; XLVII, figs. 4–6.

[*Bombyx yama-mai* GUÉRIN, Rev. Zool. (2) XIII (1861), p. 435; Pls. 11–13.]

I am indebted to Prof. Sasaki for the eggs, which hatched at the end of March.

Larva.—Stage I: Freshly hatched. Length 6 mm. Head large, chestnut red. Body thick, of the general saturnian shape of the larva of *Telea*, etc., at the same age. Body straw-yellow, with a narrow black and a lateral or subdorsal black stripe, the latter a little narrower than the dorsal stripe; this dorsal stripe stops at the median tubercle on the eighth abdominal segment, while behind this tubercle is a transverse black line or suture between the eighth and ninth segments.

The setae or hairs are at first brown, very soon becoming black, but the tubercles at first are all yellow; afterwards they begin to turn black at the base, the ends remaining yellow; at the end of the stage they all become black. Thus, when from 24 to 36 hours old, the two dorsal tubercles on the third thoracic tubercle become black, as also the median one on the eighth abdominal segment. There is also a black triangular patch on the suranal plate, and one on the side of each anal leg.

The tubercles of the second and third thoracic segments are very large and conical; the median tubercle of the eighth abdominal segment is double, high; the two dorsal ones on the ninth segment are high, and the supraspiracular tubercles are prominent.

[1] [The *A. paphia* of Kirby's Catalogue, from West Africa, is *Nudaurelia dione* (Fabr.).]

In the freshly hatched larva the black dorsal or heart line is heavier and more distinct than in the larva at the end of this stage.

Cervical plate of the prothoracic segment gamboge-yellow, the front edge around each submedian tubercle whitish.

The hairs above are brown-black, while low down on the sides of the body, on the head and prothorax, they are whitish.

The dorsal setae are rather stout, with slightly marked short spinules, while the setae of the lateral tubercles (supraspiracular and infraspiracular series) are slenderer, with longer delicate spinules, and longer than in *Telea polyphemus*, stage I, being about three times as long as the tubercle itself.

Larva.—Fully grown. June 18, 1901. Length 75 mm. Of the size and general appearance of *Telea polyphemus*, but the segments are not so angular and distinct. Head large, rounded, nearly one-half as thick as the body, smooth, with pale hairs of uneven length in front upon and on each side of the clypeus; green a little darker than the body, which is of a delicate pea-green, the hue of the underside of oak leaves.

Prothoracic segment lunate, the cervical plate yellowish on the front edge, and behind greenish yellow. A few minute hairs on the front edge, but no warts, except a small 3-setiferous dark green flattened one low down on each side of the same segment. Second and third thoracic segments decidedly convex, the two dorsal tubercles, one on each side, fleshy, quite distinct, giving rise to two or three long black hairs, and four short, rather sharp stout setae; the two tubercles are connected by a dark dusky shade. There are similar but smaller tubercles on the first and second abdominal segments with six straw-yellow hairs arising, two in a line across the segment, one dark one on each tubercle, and three or four spines. On abdominal segment 3–9 the tubercles are nearly obsolete, bearing only one or two hairs. While the dorsal and supraspiracular lateral tubercles are green and of the same hue as the body, those of the lowest infraspiracular row are turquoise blue; two on the side of the second and third thoracic segments, the lowest being situated just above the base of the legs.

On the side of the second and third thoracic segments, just above each spiracle, is a conical metallic polished silvery smooth tubercle, each bearing a slender black hair; the tubercle on the second segment is a little larger than the one behind it.

The skin is dorsally and on the sides covered with scattered minute clavate whitish setae, as usual in the larvae of this family.

On the eighth abdominal segment is a small but distinct tubercle, with two or three spines on each side, showing its double origin. The yellow hairs are about one-third as long as the body is thick. Spiracles pale yellowish testaceous. A lateral whitish yellow line just above the spiracles and slightly edged above with livid or liver brown; on the eighth abdominal segment the liver-colored brown predominates, and becomes the very distinct livid brown of the edge of the suranal plate and sides of the anal legs. The thoracic legs are pale, the abdominal ones all green except the anal in part; the abdominal legs bear on the sides black and white hairs.

Cocoon.—Regularly oval, no stalk, the surface like that of *Bombyx mori;* a large opening in front; color a rich greenish yellow. Length 43 mm.; thickness 22 mm.

ANTHERÆA PERNYI Guérin.

Plate XXVII.

[*Saturnia pernyi* Guérin, Rev. Zool., 1855, pp. 6, 297; Pl. 6, fig. 1.]

The tip of the male antennæ of *A. pernyi* and *yama-mai* end in a simple point, with rudimentary pectinations, more so than in *T. polyphemus*.

The fore wings of ♀ are less falcate than in *A. yama-mai*. The dislocated basal band is redder than in *A. yama-mai*, and the extradiscal band is distinctly red, while that of *A. yama-mai* is dusky brown, and the band beyond is distinctly white, while the same portion of the band in *A. yama-mai* is narrower and pinkish. The ocellus on the fore wing of ♂ has a large round clear space, while in ♂ *A. yama-mai* it is small and narrow oval; in ♀ the clear space is rather small and oval, while in ♀ *A. yama-mai* it is large and round. In *A. pernyi* ♀ the outer half of the

ocellus is concolorous with the fawn-brown of the wing, while in *A. yama-mai* it is straw-yellow; in ♂ there is no outer dark semicircle, while it is present in the ♂ of *A. yama-mai.*

The ocelli of the hind wing of *A. pernyi* is much as in *A. yama-mai,* but has more red on the inside, and the black ring is narrower and less heavy.

The two species are very closely allied and apparently are of recent origin; perhaps *A. yama-mai* is the later of the two forms, as its wings are scalloped, and scalloped wings are apparently a secondary modification. The white extradiscal line of *A. pernyi* and the dark brown band of *A. yama-mai* distinguish the two species.

Geographical distribution.—North China; *A. yama-mai* is the Japan form; they are probably only climatic forms.

Larva.—Stage III: Length 25 mm. Ready to molt October 1. Food plant, oak. Body of the general shape of *Telea polyphemus,* but with longer setæ. The segments are decidedly convex and angular. The larva differes chiefly from *Telea polyphemus* of the same stage in the very long bulbous black setæ, and in the entirely orange tubercles. Head color of a sere or faded leaf, spottled with black in front; clypeus and labrum paler. The rest of the body pale delicate pea-green.

Tubercles large, well developed, all orange colored, except those of the lowest row, which are green.

The dorsal tubercles on the third thoracic segment are a little longer than those on the first abdominal segment; those on the second intermediate in size between those on abdominal segments 1 and 3; those on abdominal segments 2–7 are all of the same size. The median dorsal tubercle on the abdominal segment 8 is as large as either one of the two dorsal ones on abdominal segment I. No external silvery spot on the base, there being a very minute spot on the front of the dorsal tubercles. The corresponding spots on the second and third thoracic and first and second abdominal segments are much larger and more conspicuous, those on the first abdominal segment being the largest. A similar elongated oval silvery spot on the outside of the base of the lateral tubercles on the second and third abdominal segments. From two to six black hairs arising from each tubercle (six hairs on the dorsal tubercles), the hairs are long, slender, and bulbous at tip. There are eight such hairs on the median (eighth abdominal) tubercle, which show signs of its double origin. The longest of these hairs are nearly one-half as long as the body is thick.

A lateral yellowish band, inclosing the orange tubercles, situated above the minute linear black spiracles, which becomes flesh-colored on the last segment. The tubercles of the lowest lateral (infraspiracular) row are dull green and small. All the legs, both thoracic and abdominal, are yellowish green. Body speckled, especially on the sides, with what at first look like fine whitish dots; these dots are battledore-shaped setæ. The minute hairs scattered over the body are pale green.

Stage IV: The larvæ molted October 4 or early on October 5. Described October 5, p. m. Segments still angular and convex. Length 30 mm. Tubercles yellow (not orange), the lowest lateral row remaining green. The hairs are still dark bulbous, and some nearly as long as the body is thick, a *few fully as long,* those arising from the dorsal are supraspiracular tubercles. The flesh-brown line is now more distinct on the edge of the suranal plate, and concolorous with the hinder part of the anal legs; between this area and the green anterior part of the last segment is a white line.

Head with two parallel large black-brown spots, on each side of apex of the clypeus, and four small black dots on each side of the head.

The lateral tubercles on abdominal segments 2–4 *very large and conspicuous, being swollen and with a glistening surface, much as in the later and final stage.* The three hinder of the setæ on the dorsal tubercles of the second and third thoracic and first abdominal segments *have become stiff acute dark spines* nearly or two-thirds as long as the tubercles themselves; the anterior three setæ remain from this stage onward to the last long hair-like setæ ending in bulbs. The black spiracles are now large and more conspicuous, those on abdominal segments 7 and 8 are raw sienna in hue. The yellowish lateral band is *more reddish toward the end of the body.*

The metallic silvery spots on the outer side of the dorsal tubercles glisten and shine when the larva moves, and appear to serve as a warning feature. At first, in this stage they are no larger than in the previous stage, but soon after ecdysis the striking ornaments rapidly enlarge both on the dorsal and lateral tubercles, becoming larger and more conspicuous, much as in the full-fed larva.

The battledore-like white setæ are more conspicuous than before. On the second and third thoracic and first abdominal segments is *a small oblique black spot extending from the spiracle upward along the outside of the lateral tubercles.* A black ring at the base of the thoracic legs. The ends of both thoracic and abdominal legs are flesh-reddish. The stiff thick hairs on the base of the abdominal legs are black.

The median tubercle on the eighth abdominal segment is still wider than long seen from above, with four long hairs on each side. Some of the long pale green hairs arise along the back near the tubercles, with them occur other minute ones; they all arise between and near as well as outside of the base of the tubercles.

The larva molted October 20 and stage V was described on the 22d.

Stage V: Length 35–40 mm. The golden marks were not very distinct at first, but became more so on the second day. Body bright pea-green, paler above than below. Head pale ash-brown, with a black-brown V-shaped mark in front (the edge of the V-shaped clypeus being black-brown), with a short black line on each side; also eight black spots on the front of the head, six above the clypeus; and one not far from the front edge of the clypeus. There is also a faint broad dark shade on each side of the head.

Body thick, the segments very convex and angular. The attitude of the larva at times is perfectly sphinx-like, the head being held upward and backward in the well-known position. Prothoracic dorsal plate green edged with yellow. No tubercles, but in place of them vestigial flattened ones, two on each side, each giving rise to 4 dark hairs, and other shorter hairs. The dorsal tubercles of the second and third thoracic segments large and high, conical, both pairs of the same size, those of the first abdominal segment a little smaller, while those on segments 2–7 are about one-half as large as those in front; the median one on the eighth abdominal segment is about as large as those on the second and third thoracic segments. On these tubercles, as in stage IV, the setæ arise from the front portion of each tubercle, they are brown in color and still very long—two-thirds as long as the body is thick—and still end in a distinct bulb, which, however, is shorter than in the adult; arising on the hinder side of the extremity of each tubercle are 3–4 stout curved spines. The median tubercle on the eighth abdominal segment is yellow and still wider than long, showing signs of its fused or double origin in a slight median impressed line; this tubercle bears no spines, but four long curved setæ. Other setæ are scattered between and outside of the dorsal tubercles and they are green still, as in stage IV.

On the outside of the dorsal tubercles of the first and second abdominal segments the bullate tense brilliant pearl-silvery spots are now very distinct; those on the abdominal segments behind much smaller and indistinct. Three of the tubercles of the supraspiracular row are rather larger than on the third segment, being but little smaller than those in front, and they cover more of the tubercles, only the inner aspect being green. Infraspiracular row of 11 tubercles small, *but of a beautiful turquoise blue tint,* with long radiating brown hair-like setæ. *A still lower row of three turquois blue tubercles on the thoracic segments,* one on each segment, situated just above each pair of thoracic legs.

Spiracles black, except the first (on first thoracic segment) and last (on eighth abdominal), which are brown, with the median slit-like opening yellowish-brown. On the abdominal segments 5–7 an oblique dark streak above the spiracles.

Lateral spiracular line of a delicate orange-red, becoming brownish on the ninth abdominal segment, and greatly widening on the edge of the suranal plate and farther expanding on the anal legs; the hue of this line or band is much as in that of the leaf stalks of the oak, though less reddish, but the protective resemblance is similar to that observed in the larva of *Telea polyphemus.* The lower side of the brown area is shaded with white. The body is also thickly sprinkled with the white battledore-shaped setæ, especially near the spiracular region. The

hairs on the lower side and on the abdominal legs are dark, almost black; as are those arising from the blue tubercles. *The tubercles of the spiracular row are now flesh-colored, not green.*

Thoracic legs pale yellowish brown; abdominal legs green, including part of the anal pair; the plantæ are dark flesh in color. The principal change from the preceding stage is in the blue color of the tubercles of the infraspiracular series.

Stage VI and last: Molted November 3 at 5.30 p. m. Described November 10. Length 38–45 mm.; the larva were undersized from being fed on hard, dry oak leaves so late in the season. Directly after hatching the head is pale whitish, with a greenish tint and no spots. The body very soon becomes greenish, and the red lateral band afterwards appears. In a few minutes the hairs on the head and thoracic segments, at first limp and soft, straighten out; those behind on the abdominal are still moist and curled up. At 6 p. m. the front edge of the prothoracic segment had become straw-yellow. All of the suranal plate and the sides of the anal legs are now whitish. The silvery spots are still dim, not yet bright and shining. The thoracic legs are whitish and limp; the abdominal ones green. Three hours and a half later (9 p. m.) the black spots on the head had appeared, being as in the previous stage, but the head was still pale whitish and the legs limp and white. The long white hairs of the abdominal segments are now extended at their full length. At 3 p. m., November 4, the head and legs had become browner and the larva had begun to feed.

Head large, nearly as wide as the body, ash-brown; front with eight conspicuous black dots; clypeus-posterior edged with black, with a short black line on each side; also on the side of the head a short dark shade passes up a little way from the ocelli.

Body cylindrical, the segments convex, somewhat angular, beautifully pea-green in hue. Anal legs large, much as in *Telea*. The larva differs from that of *Telea* in the body being provided with long hairs arising from the tubercles, these hairs being distinctly bulbous at the end and dark brown, while there are other pale yellowish hairs arising from near or between the tubercles. One of these flattened (?) hairs arises from in front of each tubercle. The longer hairs are about two-thirds as long as the body is thick. No tubercles on the prothoracic segment, only low flattened vestiges giving origin to fine slender hairs projecting over the head. The silvery spots on the tubercles as bright as in stages IV and V. All the tubercles (except those of the lowest series) of a pale purplish blue; the lowest (infraspiracular) tubercles much deeper turquoise-blue, as in stage V. There are four stout spines on each dorsal tubercle, besides the hairs, as in stage V. The hairs below the spiracular line and on the abdominal legs black.

There are in this stage four large conspicuous metallic bullate spots on the dorsal region of the first and second abdominal segments and on the sides of abdominal segments 1–3. The battledore-shaped white hairs as in stages IV and V. The lateral reddish and livid line, and the color of the anal legs as described under stage V. The spiracles of the prothoracic and eighth abdominal segments pale sienna-brown; all those between are black with a median pale brown slit. The tubercles in general as in the previous (fifth) stage.

The dorsal tubercles of the third thoracic segment a little larger than those before or behind. The median tubercle on the eighth abdominal segment scarcely one-half as large as the dorsal thoracic ones and now showing little signs of the median furrow, though the setæ are grouped together on each side, i. e. arranged bilaterally; yet the tubercle seen from above is broader than long. The legs, both thoracic and abdominal, are as described under stage V.

ANTHERÆA PERNYI ROYLEI (Moore).

The Indian form or local subspecies of *A. pernyi* (cf. Hampson). There are 10 specimens in the British Museum, all slightly paler than the China, Amur, and Japanese examples of *pernyi*. The cocoon of *pernyi* has a stalk, that of *roylei* is without (Hampson). *A. roylei* is from Darjeeling, N. W. Himalayas.

[Hybrids have been bred; *pernyi* ♂ × *roylei* ♀ (hybr. *kirbyi* Tutt.) and *roylei* ♂ × *pernyi* ♀ (hybr. *moorei* Tutt.). *A. pernyi* has also been crossed with *A. yama-mai* (hybrids *perny-yama* Bourd. and *inversa* Tutt.)].

ANTHERÆA SEMPERI Felder.

Luzon, Philippines. The male has much smaller ocelli than the female. Evidently a local form of *A. pernyi*.

ANTHERÆA HARTII Moore. [1892.]

Manchuria.

Imago.—A pale umber brown species, with rather large ocelli, ocher externally and on inside faint purplish, concolorous with the extradiscal band common to both wings. [Jordan describes it as dark brown, fringes bright yellow; ocelli almost alike on both pairs of wings, surrounded by a narrow black ring, outer half yellow, inner half brownish red, transparent pupil round, large.]

Larva.—(Mature; one blown, very poor, and one alcoholic, turned black).[1] [Length about 68 mm.] Body cylindrical, of usual *Telea* shape and size, segments moderately convex. Lower lateral tubercles on prothoracic segment, nine hairs in place of each dorsal tubercle; two rather large broad low-conical dorsal tubercles on second and third thoracic segments, each having five to six spines, and also hairs of unequal length; those of first and second abdominal segments much smaller, about a third as large and the dorsal ones of segments 3 to 7 [sub] obsolete, represented by a low flattened small tubercle with six spinules, one longer than the others; the single median tubercle on eighth segment is small, low, vestigial, with long unequal stiff hairs. Anal legs dark with a paler (yellow?) line. Over the supraspiracular tubercle on second abdominal segment is a clear, swollen, vitreous, roundish area, situated between the spiracle and the tubercle. Body with thickly scattered minute short clavate hairs. In the alcoholic specimen the dorsal tubercles on second and third thoracic segments are rather large, but low, not prominent. The tubercles are soft, perhaps partially erectile, the median one on eighth segment quite large and about two-thirds as high as those on second and third thoracic segments.

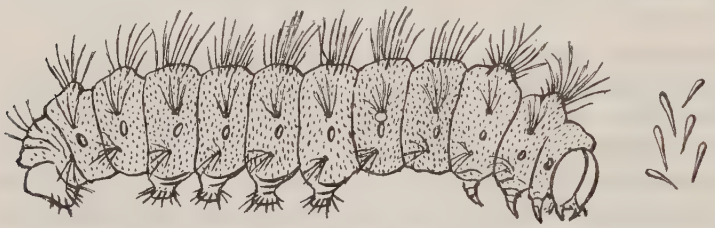


Fig. 19. *Antheræa hartii* Moore. Knight del., from larva in British Museum.

Cocoon.—Oval [yellowish white], with a stalk.

ANTHERÆA FRITHII Moore.

Antheraea frithii Moore, Cat. Lep. Mus. E. I. Comp. II, p. 396, 1858.
Antheraea frithii Moore, Proc. Zool. Soc. London, p. 256, No. 3, Pl. LXV, fig. 1, 1859.
Antheraea frithii Butler, Illustrations Lep. Het., V, p. 59, Pl. XCI, fig. 8, 1881.

♀ Very near *yama-mai*. Same hue. Ocelli slightly larger and without the thickened black spot on front side of ocellus of hind wings. Extradiscal band of hind wings more scalloped. ♂ more distinct than ♀. Ochre yellow patch on costa near apex; forewing more falcate, more deeply excavated; extradiscal lines on hind wing much more scalloped. Ocellus of fore wing a little more elongated elliptical, not so round.

[Darjiling.]

ANTHERÆA HELFERI Moore.

[*Antheraea helferi* Moore, Cat. Lep. Mus. E. I. House, II (1859), p. 397.]
[*Caligula helferi* Kirby, Cat. Lep. Het., I, p. 760.]

Small, no clear space, with very falcate wings filled in with scales and a black subapical spot. Hind wing ocelli like *yama-mai*, but clear space obsolete, and black thickening is wider than even in *yama-mai*.

[Darjiling.]

[1] [Jordan states that it is green, with a golden spot at the base of most dorsal warts.]

ANTHERAEA MYLITTA (Drury).

Plate XXVIII, fig. 1; CIV.

ANTHERAEA PAPHIA (Linné).

Plate XLVII, fig. 1.

[The following notes are from a blown larva in the Paris Museum, referred to "*A. paphia* L. (*mylitta* Drury)":] [1]

Larva.—Shape and size of *Telea polyphemus;* head chestnut, deeply incised above the clypeus; thoracic segments convex; second and third, and first abdominal angular; prothoracic segment with a lateral well marked tubercle in front of spiracle, and one, more prominent, below; other lateral tubercles on rest of body minute, and greenish. Two dorsal tubercles of second and third thoracic segments quite large, golden yellow in front, the posterior more membranous part with six small tuberculets bearing small stiff hairs, one larger than the others. Homologous tubercles (two dorsal) on first abdominal segment one-third smaller than the others, while those on segment 2 are a little smaller, and those on the other segments are a little smaller still, and give rise to a single dark hair and two or three small hairs. The dorsal tubercle on eighth abdominal segment is *represented by two separate* (a mm. apart) *minute yellowish low flattened tubercles, each bearing a single hair,* not to be seen in profile as also in Moore's figure (Lep. Ceylon, vol. 2, Pl. 125, Ib.). Entire body green; a lateral reddish line, widening on side of suranal plate, which is green above, as rest of body. Abdominal legs with black short hairs; anal legs behind reddish, forming a large triangular spot, apex toward planta. Spiracles yellow with a black ring within. Thoracic legs reddish. A white spot above second abdominal spiracle (Moore makes two crescentic white [spots] above second and third abdominal spiracles). [Length about 77 mm.]

In earlier stages, half as large, all the tubercles larger, red, with stiff hairs as in other genera; see Moore's figure.

TELEA Hübner.

[*Telea* Hübner, Verz. bek. Schmett (1822?), p. 154.]

[The primaries have ten veins; vein 7 and 8 form a long stalk out of the subcostal, and vein 9 also from the subcostal, very close to the inception of vein 8. There is thus an essential difference between this genus and *Actias,* in which vein 9 is from the same stalk with 7 and 8. The dorsal vein is furcate, rather an unusual feature in this group. The secondaries are, as usual, 8-veined, vein 7 very strongly curved.—J. B. Smith, Proc. U. S. Natl. Museum, IX (1886), p. 429. That is to say, III_1 originates far basad, being the first vein to separate from the radius, as in *Eacles.* III_2 is absent, III_3 and III_4 separate at about the same level as IV_1 and IV_2, the common stalks of each pair joining just beyond the origin (separation) of III_1.]

TELEA POLYPHEMUS (Cramer).

Plate XVII, figs. 3–5; XVIII; L, fig. 1; LVI; LXVI, figs. 1, 2 (*oculea*); LXXIV, fig. 1.

[*Attacus polyphemus* Cramer, Pap. Exot., I, t. 5A,B (1775).
Bombyx polyphemus Fabricius, Spec. Ins., II, p. 168, n. 5 (1781).
Telea polypheme Hübner, Samml. Ex. Schmett II, (1824?).
Telea polyphemus W. F. Kirby, Cat. Lep. Het., I, p. 751 (1892).]
Telea polyphemus Dyar, Proc. U. S. Nat. Mus., XXVII, p. 792, June 7, 1904.

Imago.—Four ♂, four ♀, and others examined. Body and wings tawny ochreous brown, varying from a paler to a deeper shade. Prothorax and costal edge of fore wings whitish gray, becoming less distinct on the under side. Fore wings, tawny ochreous brown, brighter clear ochreous on the margin of both wings beyond the submarginal band. Within the basal line also slightly clearer ochreous, being freer from black scales. Basal line widely dislocated on the

[1] [This must be *A. mylitta* (Drury); syn. *paphia* Cramer, not Linné. The Linnean *paphia* is given in Kirby's Catalogue as equal to *Nudaurelia dione,* but Rothschild considers it to be an entirely different thing, and identical with *Antheraea jana* (Stoll) and *rumphii* Felder, supposed species described from Java and Amboina, respectively.]

median vein; it begins behind or at the hinder edge of the costal band and is either straight or incurved in its course to the median vein, and thence to the inner edge of the wing is either nearly straight or slightly sinuous; it is broad, white, edged with pink and beyond narrowly bordered with black. The extradiscal line is nearly straight or slightly sinuous, ending in the two black spots on the costa, the spot on the costal edge linear, the one parallel to it on the inside being about twice as broad, and in one ♀ nearly triangular; the line tends in some specimens to become obsolete toward the apex and near the two black costal spots; the band is dark brown, shaded externally rather irregularly so as to be scalloped on the outer edge with pale gray lilac, or pinkish white.

On the hind wings this line is curved and is twice as broad as on the fore wings, and especially the inner dark brown portion is broadest toward the middle and costal region. From the inner of the two black spots a broad grayish lilac shade or dash passes nearly out to the apex. At the outer end of the other or linear spot is a short mark of the same hue.

Discal spots rounded, elliptical, varying much in size, those of the fore wing with the transverse diameter greater than the longitudinal, the anterior end or side always reaching to vein II, but the posterior never touching median, and in some examples the spot only extends half way across the discal cell. In a well-developed discal spot or ocellus the vitreous or transparent center is about half the width (in one ♀ much wider) of the entire ocellus, the discal vein dividing it into two unequal portions, of which the inner is the smaller. This vitreous center is surrounded by a broad ochre-yellow ring, wider on the outer than inner side, sometimes nearly twice as much so; it is edged with a narrow linear black ring, and externally on the outside is a narrow linear whitish-blue semicircle, not extending beyond either end of the discal vein.

Hind wings entire. Apex subacute, the outer edge bent at the end of the median vein. Extradiscal line curved outward, a broad, diffuse dusky band, shaded externally with grayish lilac, and beyond this line the wing is ochreous as on the fore wings. Discal spot very large, and the ocellus itself, corresponding to that of the fore wings, is a little larger than in the anterior wings and of the same general shape, but produced sharply at each end (antero-posterior); the yellow ring is decidedly thicker on the outside and is edged with a distinct fine linear black line. It varies in size, either reaching the origin of the first median vein or ending quite a distance from it. The ocellus proper is surrounded by a large oblong oval black shade, not only filling the space or cell, but spreading over a little way into the cells on either side of the veins II and median. It is bounded on the inner end by a red and white line, being a portion of the basal line, and situated about half way between the base of the wings and the discal vein. On the outside of the ocellus is a faint linear pale blue semicircle, while on the other side of the ocellus or yellow ring about half and sometimes nearly two-thirds of the black patch is colored pale blue, the blue scales varying in intensity and in some examples almost wanting.

Under side of the wings. The basal band of fore wings dark, the wing within paler and more grizzled than the rest of the wing. On the hind wings this portion sends two narrow streaks, one to each side of the ocellus, then spreading out trigonately. Middle of wing darker, nut-brown, the outer edge of this shade vaguely scalloped, and the inner edge also in some examples; this shade or broad band is succeeded by a lighter shade, either pale ash or dusky lilac, the outer edge darker, corresponding to the extradiscal line above. The edge of the wing is either pale ochreous or ochreous brown. The two apical spots are disconnected from the extradiscal band. In the median shade a dull reddish brown, broad, diffuse band crosses the wing, inclosing the discal spot when it is small, and when the spot is large, being interrupted by it.

There is no essential or striking difference between the sexes.

Expanse of fore wing, ♂ 116–127 mm.; ♀ 125 mm.

Length of wing, ♂ 55–58 mm.; ♀ 66 mm.

Ocellus of fore wings: Length, 2½–7 mm.; width, 2–7 mm.

Ocellus of hind wings, not including the black and blue patch, 4–7½; black patch, 10 by 6 to 16 by 12 mm.

In a quite pale ♀ the ocellus of the fore wings is unusually large and round, and the vitreous center large and round.

The discal ocellus varies greatly; in one ♂ from Brunswick, Me., it is reduced to one-third the size of that in the hind wings, and only extends to a little more than half way across the discal cell, while there is no clear vitreous center (that in the ocelli of the hind wings is very small), the yellow ochre oval spot being solid, opaque, with a few blue scales on the inside; on the left wing the yellow spot is still smaller, shorter, and irregular.

[*Geographical distribution.*—Very widely distributed over the North American continent, especially east of the Rocky Mountains. The following localities are from the records of the United States Department of Agriculture: New York (Pawling, Brooklyn); New Jersey (Waldwick, Hammerton); Pennsylvania (Dreshertown); Ohio (Toledo); Illinois (Manchester, Malta); District of Columbia (Washington); Maryland (Towson, Hagerstown); Virginia (Farmville, Manassas, Norfolk); South Carolina (Summerville, Edisto Island); Alabama (Montevallo, Greensboro); Georgia (Thomasville, Brunswick); Tennessee (Washington College); Florida (Jennings, Eustis); Louisiana (New Orleans); Kentucky (Frankfort); Texas (Paris, Clear Spring); Kansas (Oswego); Missouri (Cadet, St. Louis); Colorado (Fort Collins); Oregon (Jefferson); California (Fillmore, Niles, Mountain View).]

Fig. 20.—*Telea polyphemus* male. Tibial spur; shiny, with inner surface covered with very fine short setæ.

[Mr. T. Pergande bred three *T. polyphemus* from cocoons found by Prof. Comstock on water oak at Macon, Ga. He notes: "The moths are of a purplish color, appearing different in this respect from the northern form of *T. polyphemus.*"]

[Prof. M. H. Swenk reports (litt., 1912) that in Nebraska *T. polyphemus* occurs across the State, at least northwardly. "It is common in eastern Nebraska, and Mr. Dawson has taken it at Gordon, Sheridan County, and in Monroe Canyon, Sioux County."] "Found from British Columbia [eastward] (but rarely) across the prairies to Manitoba. It is one of our most abundant species of large moths throughout Ontario. * * * I have seen it in Montreal collections." (J. Fletcher, litt., 1900.)

Var. OCULEA Neumœgen.

[Papilio, III, p. 71 (1883).] Grote, Ann. and Mag. N. H., ser. 5, XI, 1883, p. 53.

Two ♀ from Prescott, Ariz., present the following characters: They are of unusual size. The light ground color is as pale as my lightest northern ♀, while the dark middle portion of the wing and the dark spot inclosing the ocelli of both pairs of wings is of much greater extent than in any examples from the New England States.

This variety of the southwestern or arid region of Arizona and New Mexico differs from the normal northeastern forms in the basal line showing more white, while the black outer edge is wider and more distinct; between this black and white band is a narrow deep ochreous line; the rest of the line from the median vein to the inner edge of the wing is a simple slightly curved dark brown band. The extradiscal is (on the fore wings) a straight broad black-brown band of even width extending to the two costal spots, but with no gray-lilac shade beyond; on the hind wings this band is wider and regularly curved. Between this and the ocellus the wing is unusually blackish, and between the extradiscal and the ocellus is a faint brown line which curves in a little before reaching the costa (this line is not present in northeastern examples). The roseate patch near the apex behind the two costal black spots is more distinct than in the northeastern examples. Ocelli of the fore wings large, extending from the 4th II to the 1st median or almost to it; the vitreous or clear center round, as wide as long, and the whole ocellus surrounded by a *broad diffuse black ring*, which is prolonged to the 2d median vein in one example, forming a *large triangular black patch*, which interrupts the transverse brown line. (In the other example the black only reaches the 1st median vein, and the brown line is farther away from the discal spot, nearly one-half way between the extradiscal line and the spot.)

Discal spots of the hind wings very large, though the ocellus itself is a little smaller than that in the fore wings. The blue crescent is wide and intense in hue next to the ocellus; the

inner half (within the discal vein) is deep orange yellow, the outer paler (in both wings). The black cloud or patch is wider and rounder than usual.

Under side of wings much paler than in the normal form, especially in the outer margin of the wings. The broad median band or median third of the wing is brown on the edges and regularly scalloped externally, and irregularly so on the inside; the band is much more distinct and more regularly scalloped on the hind wings. The ocelli are smaller than above, and not so round.

Expanse of fore wings, ♀ 150–168 mm.
Length of fore wing, 71–80 mm.
Ocellus of fore wings, 9 by 8; of hind wings, 8 by 8 mm.; on the under side of fore wings, 8 by 8 mm.; of hind wings, 5 by 6 mm.

Whether this is a dry geographical race, peculiar to Arizona and the neighboring nearly rainless, hot, arid regions, remains to be seen when we have more specimens for examination. It is not decidedly paler than eastern examples and has considerable black in the spots and bands. Did I not have a nearly similarly pale ♀ from the Eastern States (exact locality unknown), I should be inclined to regard *oculea* as a climatic variety, but until we have seen the larva, we should hesitate about regarding it as such. [Var. *oculea* was taken by Snow in Gallinas Canyon, N. Mex.]

[Mr. J. Doll writes (litt., July, 1912) that the type female of *T. polyphemus oculea* "Differs in pattern on the under side of hind wings in the wide bands almost uniformly on middle third," and adds, "all our *oculea* have the marked dark dash extending basally from the eye-spots on the primaries." Mr. Doll further expresses the opinion that Druce's figure of *T. aurelia* in the Biologia Centrali-Americana is "a fine figure of the ♂ of *oculea*." Strecker (litt. to Dr. Packard) also expresses the opinion that *aurelia* was *oculea*.]

[A female from Albuquerque, N. Mex., June, 1902 (J. G. McNary), must be referred to *oculea*, although it lacks the evident dark shade basad of the ocelli on the primaries. It is large (length of primaries about 69 mm.) and has little light color beyond the dark submarginal band, agreeing in this last character with the Mexican race (Pl. LVI, figs. 3, 4) as well as with *oculea*. The general color of the upper surface is very warm but light ochre-red, and the white part of the upper section of the subbasal band on primaries is very broad and conspicuous. On the under side the median broad area is shaded with a very fine cinnamon-red, while the basal part of the secondaries is very white. The red median area on the hind wings is very broad.

I do not know how far north *oculea* occurs, but at Boulder, Colo., the insect is smaller, with a strong white or pinkish shade beyond the submarginal band, and must be referred to *polyphemus* proper. There are, however, several varietal forms:

Var. a.—General color above warm reddish-ochreous, like the Albuquerque *oculea*, but region of wings beyond ocelli and before submarginal band more blackish; pinkish white shade beyond submarginal band very distinct; ring round hyaline area on primaries (as in all Boulder specimens) pale yellow (in the Albuquerque *oculea* it is cinnamon); under side with more blackish scales than in Albuquerque *oculea;* band on hind wings very much narrower, and basal part hardly whiter than the part beyond the median band. Female. Boulder, July 20, 1906 (F. W. Rohwer).

Var. b.—Strongly vinaceous-red; shade beyond submarginal band delicate pale lilac; area around ocelli of hind wings strongly blackened; under side also strongly vinaceous, the lighter parts of the secondaries suffused with pink; the median band of secondaries broad, formed essentially as in the Albuquerque insect, but darker and more vinaceous. Male. Boulder, June 3, 1912. Received from Miss Eva Miller. The female of this form (except that it lacks the black suffusion around ocellus of hind wings) is figured by Holland in The Moth Book, Pl. IX, fig. 1.

Var. c (ab. nov. *olivacea*).—Ground color above pale grayish olivaceous; shade beyond submarginal band white. Under side marked like var. *b.*; but colors olivaceous, with no vinaceous or reddish whatever; dark markings deep brownish olivaceous; basal part of second-

aries whiter than in the other Boulder forms, but not so white as in the Albuquerque one. Boulder. July, 1912 (O. Wangelin).

Other variations occur in the Eastern States. Dr. Holland states: "I have one or two fine melanic specimens, in which the wings are almost wholly black on the upper side. Albino specimens are also occasionally found." Strecker (litt. to Dr. Packard, 1900) noted that a male he raised from a cocoon sent by O. T. Baron from Mendocino, Cal., was quite typical *polyphemus*.]

Life history.

According to Mr. E. B. Reed, this insect "frequently attacks maples, and from the enormous size of the caterpillar and its voracious appetite a great deal of damage is often done." (Report Ontario Ent. Soc. for 1872, p. 39.) Mrs. Dimmock has contributed the following historical account of this insect to Psyche, IV, 277:[1]

Harris (Rept. Ins. Injur. Veg., 1841, p. 278–279) describes larva, cocoon, and imago; later (Treatise on Ins. Injur. Veg., 1862, p. 384–386) he adds a figure of the imago, and (Entom. Corresp., 1869, p. 294, pl. 4, fig. 17) a figure of the larva. Morris (Synop. Lepid. N. A., 1862, p. 226–227) describes larva and imago, and (*op. cit.*, p. 209) describes the egg, which he mistook for that of *Smerinthus excaecatus*. Trouvelot (Amer. Nat., 1867, v. i, p. 30–38, 85–94, 145–149, pl. 5–6) gives an extended account of this species which he tried to rear, on a considerable scale, for its silk; he describes the egg, larva, pupa, and cocoon, and figures the larva, pupa, cocoon, and male and female imagos, as well as *Ophion macrurum*, a parasite of the larva; he says there are at least six varieties of the imagos. Packard (Guide Study Ins., 1869, p. 297, pl. 6–7) repeats Trouvelot's figures. Riley [?] (Amer. Entom., March, 1869, v. i, p. 121–122) figures the imago and describes the larva and imago. Riley (4th Ann. Rept. State Entom. Mo., 1872, p. 125–129) describes egg, larva, cocoon, pupa, and imago, and figures larva, pupa, cocoon, and male and female imagos; contrary to Trouvelot, who stated that there are six larval stages, Riley gives the number of molts as four, making five larval stages. Lintner (Entom. Contrib. [No.1], 1872, p. 6) gives a note on the coloration of the eggs, and (*op. cit.*, No. 3, 1874, p. 152) describes the eggs. Gentry (Can. Entom., May, 1874, v. 6, p. 86) describes the normal form and a variety of the larva. Grote (Can. Entom., Sept., 1878, v. 10, p. 176) states that this species is double-brooded in the South; Trouvelot (*l. c.*) was unable to raise two broods to maturity in Massachusetts, and Brodie (Papilio, April, 1882, v. 2, p. 60) writes that "in long and warm seasons about 50 per cent are double-brooded, but this is against the increase of the species, as cold weather usually sets in before the larvæ are fully matured." Packard (Bull. 7, U. S. Entom. Comm., 1881, p. 48) figures the larva. Saunders (Can. Entom., March, 1882, v. 14, p. 41–45) figures and describes the larva, pupa, cocoon, and male and female imagos; he further figures *Ophion macrurum*, a parasite of the larva. Brodie (Papilio, May, 1882, v. 2, p. 83) states that normally this insect comes from its cocoon at about 11 a. m. Wailly (Bull. Soc. Acclim. France, May, 1882, s. 3, v. 9, p. 265) gives some notes upon the larva and imago. A compilation of the food-plants results as follows: *Quercus*, *Ulmas*, *Tilia* [Harris, 1841 and 1862]; *Tilia americana* and *Rosa* [Harris, 1869]; *Acer*, *Salix*, *Populus*, *Corylus*, *Betula*, *Vaccinium* [Trouvelot] *Carya*, *Juglans nigra*, *J. cinerea*, *Cratægus* (Amer. Entom., 1869, v. 1, p. 121); *Quercus virens*, [Chambers (Amer. Entom., March, 1870, v. 2, p. 156)]; apple, quince, plum, *Prunus virginiana*, *Platanus*, *Gleditschia* [Riley]; *Betula lenta* [Young (Can. Entom., Oct., 1880, v. 12, p. 212)]; *Hamamelis virginica* [Kyle (*op. cit.*, p. 213)]; *Castanea vesca*, *Fagus* [Wailly (Journ. Soc. Arts, 31 March, 1882, v. 30, p. 528)]; *Tilia europæa*, *Cratægus coccinea*, *C. tomentosa*, *C. crus-galli*, *Amelanchier canadensis*, *Ribes cynosbati*, *Quercus alba*, *Q. macrocarpa*, *Q. rubra*, *Corylus americana*, *C. rostrata*, *Fagus ferruginea*, *Carpinus americana*, *Ostrya virginica*, *Carya tomentosa*, *C. amara*, *C. alba*, *Betula lenta*, *B. excelsa*, *B. alba*, *B. papyracea*, *Alnus incana*, *A. serrulata*, *Salix alba*, *S. humilis*, *Populus grandidentata*, *P. tremuloides* [Brodie (Papilio, April, 1882, v. 2, p. 58–59)]. Chestnut, as a food-plant, is only mentioned by Wailly, who reared the larvæ in England, but they are often found in eastern Massachusetts, on *Castanea vesca*.

[The following life history of *T. polyphemus* was originally published by Packard in Proc. Amer. Acad., 1893:]

The larvæ, usually feeding on the oak, have been found on the chestnut, and in Maine on the beech.

Egg.—Regularly oval-cylindrical, each end alike; flattened at each pole; surface chalky white, with a very broad, conspicuous dark-brown band. Under a lens, the surface of the shell is seen to be finely pitted or granulated; under a half-inch objective, the surface is seen to be covered with round shallow depressions bordered with a well-marked rim; these orbicular areas do not touch each other, there being quite wide spaces between them; they are arranged obliquely. Length of egg 2.6 mm., breadth 2.2 mm.

Larva.—Stage I. Hatched June 12. (Described when 20–24 hours old.)

The brood hatches all at once, or nearly so. Length 5 to 6 mm.

The head is large and full, rounded as usual in the family; as wide as or slightly wider than the body, i. e., the prothoracic segment, not taking into account the lateral tubercles. It is deep bright brick-red; the labrum, antennæ, and jaws yellowish. The body gradually tapers backward from the head.

[1] [Abbot and Smith, Nat. Hist. Lep. Ins. Georgia, vol. 1 (1797), p. 93, figure *T. polyphemus* as feeding on *Quercus lobulata* Solander, MSS., the tree now known as *Q. stellata*.]

The body is of a soft, pale greenish yellow; the tubercles pale yellowish, contrasting with the color of the body. The prothoracic segment flares in front, the edge turning up and bearing two large dorsal tubercles which are double. The prothoracic tubercles are very prominent, projecting on each side, and are about twice as large as the second and third thoracic ones, and bear twelve bristles. These tubercles and those of the same series on the ninth abdominal segment are much larger than the intermediate ones. There is a slight differentiation in size and color of the dorsal tubercles, those of the thoracic and ninth abdominal segments being of the same size, and larger than those on abdominal segments 1 to 7, and also of a deeper yellow shade. The bristles are pale, those on all the thoracic tubercles, dorsal and lateral, a little darker than those on the abdominal segments, and darker at the tips. They are but little longer than the tubercles, and there are about six on each abdominal tubercle. Under a half-inch objective the bristles are seen to be not only docked at the tip, but the latter is slightly but distinctly swollen or bulbous, and sometimes containing an oval mass of the coagulated secretion.

The median dorsal tubercle on the eighth abdominal segment is as large as those on the thoracic segments; it is twice as wide as long at the base, *and is more deeply divided than any other of our Attaci known*, very plainly showing its origin from two originally separate dorsal tubercles; *each fork is well developed, being about as long as thick*, and each bearing from four to five bristles.

All the tubercles of the ninth segment are very large, about as large as those of the thoracic segments. The suranal plate is large, nearly equilaterally triangular, and bears near the apex two tubercles, each of which gives rise to eight bristles; they are smaller in proportion, and nearer together, than those of *C. promethea*.

The prothoracic segment is pale yellowish in front, chestnut-colored behind, becoming blackish on the sides low down. At the base of the lateral prothoracic tubercles are three black rings. On the side of each abdominal segment 1 to 8 is *a pair of parallel black slashes*, situated between each of the upper and lower lateral tubercles; on the second and third thoracic segments they meet on the middle of the back as chestnut-colored stripes. On each side of the ninth abdominal segment is a large pale yellowish amber tubercle.[1] In some individuals all the tubercles on the body are amber-yellow.

The thoracic and abdominal legs are pale greenish, with no markings. The thoracic feet bear near the ungues the usual three tenant hairs which are long-lanceolate, and moderately broad. The number of crotchets on the abdominal feet is 24, larger by 8 than in the other Attacidæ observed.

June 17 they had become larger, fuller, and from 9 to 10 mm. in length. The body is of a beautiful soft glaucous green, the tubercles yellowish, those on the prothoracic segment tinged with reddish; the black-brown slashes on the sides of the body are still present, but narrower. They are voracious feeders.

June 19, at Providence. (Like Mr. Bridgham's second drawing, stage II.) I have not seen them cast their skins, though they must have done so. They are now 11 mm. long. They still retain the black slashes. All the tubercles are yellowish; the body being of a beautiful glaucous green. In some individuals the lateral prothoracic tubercles are reddish.

Figure 21. Dorsal view of the eighth to tenth abdominal segments of the larva in stage I, showing the double tubercle (*d'*) on the eighth segment (VIII), and the two separate dorsal tubercles (*d*) on the ninth segment (IX), with the two subdorsal tubercles of this segment (*sd*), together with the suranal plate (X) and its armature.

Figure 22. A view of the double dorsal tubercle (*d'*) of the same stage, showing the median line of union of what in embryonic life were probably separate dorsal tubercles, like those on the segments in front and behind; *m*, the muscles moving the setæ; *sd*, the subdorsal tubercles; *m*, the retractor muscles of the tubercle; *a*, one of the setæ, much enlarged, with the bases of two others; *a'*, *a''*, *a'''*, ends of other setæ, containing at the end globules of the medullary fluid. The setæ are seen to be smooth, without spinules of any sort. It is to be observed that in the double dorsal tubercle there are only four setæ on one side and five on the other, but five must be the normal number, and the number usual in the larvæ of the group at this stage.

Stage II: June 23. Length 14 to 15 mm. They have most probably molted, *the lateral pair of upright parallel slashes having disappeared*. The spiracles are now black and very distinct. The tubercles are deep orange at the end, the dorsal ones bearing mostly blackish bristles, with one or two white ones, those on the side of the body being pale; the lateral tubercles are orange, all the prothoracic tubercles deep orange, and the segment itself is edged with greenish yellow orange. The thoracic legs are deep orange; the abdominal legs green, tipped at the planta with yellow orange.

There is now *a lateral curved white band connecting the lateral tubercle on the ninth segment with the corresponding one on the suranal plate*. Along the back and between the dorsal tubercles the skin has a soft glaucous bloom. The head is dark chestnut-red, as before.

In this stage the larvæ frequently assume a sphinx-like attitude, while those of *P. cecropia* and *S. cynthia* do not seem to, but these two species are in general more active, trying to escape from confinement.

Stage III: Molted July 1. Length 20 to 25 mm. The color of the head and tint of the body as before. The larva now differs in *the segments being more convex and angular*, or in tranverse section somewhat square, somewhat as in the last stage. All the tubercles are alike in being pea-green at base, becoming deep reddish orange at the end, and bearing partly black and partly white spines or bristles, except the two median short tubercles on the prothoracic segment, which are yellow, and concolorous with the yellow margin of the whole segment. There are more white bristles on the abdominal than on the thoracic segments.

[1] In *A. luna* the suranal plate is triangular, but slightly shorter than in *T. polyphemus*, the two tubercles are wider apart, not so near the end of the plate, and are much lower and flatter, while those of *T. polyphemus* are quite high and slender, papilliform.

The spiracles are unusually narrow, being vertically almost linear, and orange-red, i. e., concolorous with the tubercles at the end, and now directly behind them is the *more or less distinct yellowish lateral slightly oblique stripe connecting the lateral tubercles of the lower and of the upper row*, and which touches each spiracle. (These were indicated, though less distinctly, in stage II.)

The beautiful pale purplish whitish band or edging on the suranal plate, and connecting the two lower lateral tubercles of the ninth abdominal segment, is *now very distinct;* above it is edged within with *a linear brownish line forming a* V, which does not reach the tubercles on either side, in fact, only extends about half way from the end of the suranal plate to the base. The median dorsal tubercle on the eighth abdominal segment is still plainly double, and larger than any of the others.

We thus have assumed in this stage the characters of the larva in its final stage.

The excellent differential characters separating this genus from other Attacinæ are now defined, and the same will apply to the larvæ of the third stage of *Platysamia*, *Callosamia*, and *Actias*, as well as *Samia* (*Philosamia*).

The following descriptions apply to two individuals specially observed during this stage:

One (A) in stage II was seen to cast its skin July 5, at 11.15 to 11.30 a. m. The head was pale greenish yellow, like a peach, but without the reddish pink tinge. (*A. luna* appears to permanently retain the greenish tint.) The thoracic legs are greenish. All the tubercles are lemon-yellow, the short bristles on the thoracic tubercles black, those on the abdominal segments turning black. The long whip-like hairs are white. The V-shaped band on the edge of the suranal plate is a deep labradorite-azure. The lateral stripes are not yet very distinct. The spiracles are deep orange.

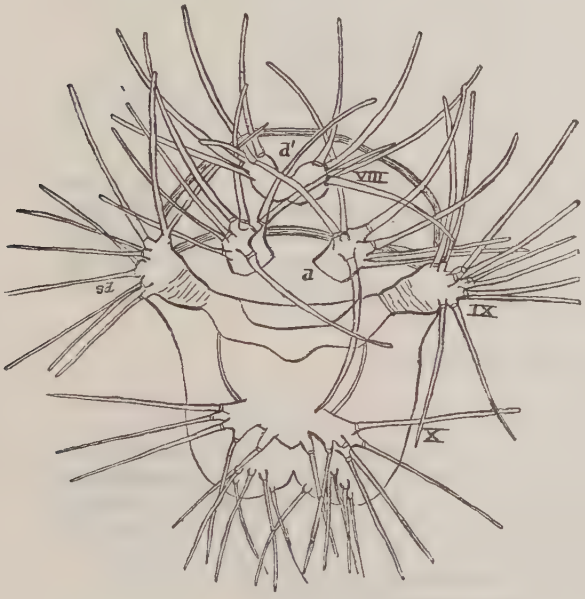


Fig. 21.

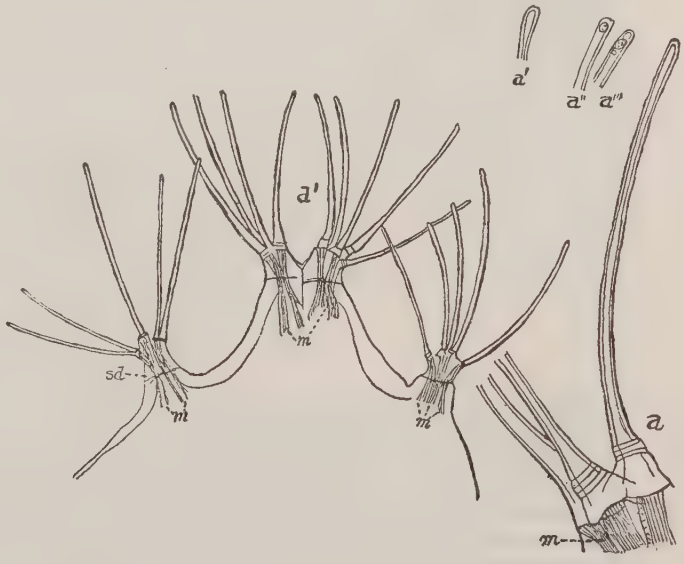


Fig. 22.

At 12.30 p. m. the head had turned almost chestnut-brown, and by 1 p. m. was of the normal dark chestnut-red hue.

Before casting its skin, it spins a thin carpet of silk threads, to which it clings with its crochets while in the process of exuviation.

Another caterpillar (B) in stage II about molting was first noticed at 11.30 a. m. The head was small, about half as large as in the next stage, pressed forward; the prothoracic segment above has a large yellow patch extending back to the next segment. The region is about half as wide as the whole segment, being that portion situated behind the two middle dorsal tubercles, and the brown membrane or neck connecting the head and the succeeding segment is tense. Now all the tubercles are deep orange-red, while there are no fine white hairs arising from the thoracic tubercles, and those arising from the abdominal tubercles are much shorter, nearly one-half, than in the next molt (A). It fastened its crochets in the silk carpet it had spun previous to the beginning of the process of exuviation, so that the convulsive movements of the head and thoracic segments may not cause it to fall over while in the act of throwing off the old skin. The head is about one-third, and almost one-half, larger after molting than before.

Now and then before the skin splits, and is cast off, the larva was observed to make a series of convulsive movements of the head and thoracic region.

It finally cast its skin between 2 and 3 o'clock p. m., and this individual looked like A when I first saw it.

This larva also was observed resting with its head and thoracic region raised in a sphinx-like attitude, jerking its head sideways when disturbed. The pale chestnut face forms, with the folded thoracic feet, a continuous patch of color, of the same tint as that of the leaf buds, and the base of the leafstalks of the oak. In eating I do not see that the maxillæ and labium are of any service, but on the contrary seem to be in the way. Both are in lepidopterous larvæ rudimentary, and the labium in the main functions as a spinning organ.

Stage IV: Molted July 11–12. Length 40 to 45 mm. This differs but little from stage III. The head is of the same color as in the three previous stages, and about half as wide as the body. The segments are rather more angular above than before. The prothoracic segment is yellow in front; the tubercles are small, and of the same yellow tint. All the other tubercles, both dorsal and lateral, are orange-red; *the dorsal tubercles have on the outside of the base, and extending nearly half way up, a bright spot with a decided pearly color and luster;* this spot is wanting on the infraspiracular tubercles. Most of the bristles are black broadly ringed with white, or white at the base, and on the distal half. The median dorsal tubercle on the eighth abdominal segment is still distinctly seen to be double, being bilobed at the end, each lobe or subtubercle bearing about four white setæ, one of them black.

Along the sides of the body project long white hairs. The spiracles are orange-brown, as before. The suranal plate is edged with flesh-pink, and the anal legs are bordered behind with the same smooth flesh-pink margin. The thoracic legs are reddish amber, black at their ends. The middle abdominal legs are green; the plantæ livid purplish; above the planta is a dark patch, bordered above with yellowish.

Stage V: Molted July 22–24. Length 60 mm. It now scarcely differs from the preceding stage. The silver tint on the outside of the base of the dorsal and subdorsal tubercles, and on the upper side of the base of the infraspiracular tubercles, is a little more distinct than in stage IV, as in the latter stage the second and third thoracic dorsal and subdorsal tubercles are more orange than those on the abdomen, which are deep coral-red; but in some of stage IV the thoracic ones are coral-red.

The head is reddish chestnut, and is the same in hue as in stages I to IV. The prothoracic segment is edged with yellow, the pale yellowish lateral stripe as in stages III and IV. The spiracles are deep orange-red. The segments are now convex and almost angular, more so than in the other native forms of this group, unless we except *A. luna*.

One of this brood began to spin and had completed the exterior of its cocoon by August 1.

The object of the purplish edging on the suranal plate and anal legs was impressed upon me while observing a large full-fed caterpillar resting by a short leafstalk, the leaf having been broken off so as to be a quarter of an inch long and curved. In color and shape it exactly resembled the purplish edgings of the suranal plate and legs, and thus added to the protective resemblance to a leaf and its stalk.

A fine large *T. polyphemus* was observed at Providence, September 27, on the chestnut. I was struck with the resemblance of the outline of the creature's back—the segments being angular so as to render the body serrate, each tooth-like form of the segment surmounted by a tubercle and long hair—to the serrated edge of the leaf, each of the teeth ending in a long hair. It is not improbable that the ancestors of Telea, Actias, and others with angular segments, may originally have fed on trees with such serrated leaves, and that later they adopted as their more usual food plant such trees as the oak, in which the edges of the leaves are either smooth or simply lobed.

Recapitulation of the more Salient Ontogenetic Features.

A. Congenital Features.

1. The setæ (bristles) of stage I but little longer than the tubercles, and both truncate and distinctly bulbous at tip.
2. A slight but distinct differentiation in size and color of the dorsal tubercles, those of the 3d thoracic and 9th abdominal segments being of the same size, and larger than those on uromeres 1–7, and of a deeper yellow shade. (Stage I.)
3. The homologue of the "caudal horn" is distinctly double, and more deeply divided than in any other American genera of Attacinæ; each fork about as long as thick. (Stage I.)
4. Abdominal legs each with twenty-four crotchets (a larger number by 6 to 8 than in the other genera), stage I.
5. Each abdominal segment (uromere) with a lateral pair of transverse black slashes in stage I.
6. The two tubercles in stage I on the suranal plate slender, papilliform, and approximate.

B. Evolution of later Adaptational Characters.

1. The lateral pair of black transverse stripes on each uromere nearly or quite disappear in stage II.
2. The segments more convex and angular in stage III.
3. Appearance of a yellowish lateral oblique stripe connecting the lateral tubercles of the lower and upper row, in stage III.
4. Appearance of the pale purplish edging of the suranal plate and anal legs, in stage III.
5. Appearance in stage IV of the pearly spot on the outside of the dorsal tubercles.

The generic characters are mostly assumed in stage III.

TELEA AURELIA Druce.

Telea aurelia DRUCE, Biologia Centr.-Amer., Tab. 83, fig. 3.
[*Telea aurelia* DRUCE, Ann. Mag. Nat. Hist. (6), IX, p. 278 (1872).]
Telea aurelia KIRBY, Syn. Cat. Lep. Het., I [p. 934], 1892.

Imago.—One ♂. Judging solely by the figure of Mr. Druce this seems to be only a climatic variety of *T. polyphemus*, differing from that species only in markings. On the fore wings the basal line is darker, the dark shades of the northern form being intensified. The ocellus differs in having the dark outer ring heavier and wider, and within it the discal space is shaded with brown to the basal line. The middle of both wings is darker and the extradiscal line common

to both wings is broader and scalloped externally. The ocellus of the hind wing is about the same as in *T. polyphemus;* the nearly clear space being as large and the yellow ring around it as wide, but deeper orange. The two apical black spots and the rose patch underneath are just as in normal *T. polyphemus*. It is of the same size, and the fore wings expand 11 cm. [Mexico.]

METOSAMIA Druce.

Metosamia Druce [Ann. Mag. Nat. Hist. (6), IX (1892), p. 276].

The only true generic difference from *Telea* is the markedly scalloped wings [of the males]. It has no affinities with *Samia*, as the name would imply.

METOSAMIA GODMANI Druce.

Plate LI, fig. 6; LXXV, fig. 1.

Metosamia godmani Druce [Ann. Mag. Nat. Hist. (6), IX (1892), p. 277].
[This is the type of the genus.]

Imago.—Also a large species, but the wings are not scalloped [in the female] and it apparently scarcely differs from *Telea polyphemus*, from which it is evidently derived. In color and markings it differs from *M. montezuma* and *T. polyphemus* in the basal line being formed of two white spots, that near the costa being triangular, the other portion of the line being a straight slash across the base of the submedian cell. Extradiscal band as in *T. polyphemus*, but on the hind wings it is straight. Ocelli of the fore wings without the blue semicircle; that of the hind wings with a small discal clear space, and no black or blue shade within, though there is a narrow blue semicircle. Female antennæ pectinated to tip. Length of anterior wing 83 mm.; ocelli 17 mm.

Geographical distribution.—[Mexico.]

METOSAMIA MONTEZUMA Sallé.

Plate LXXV, fig. 2; LXXVI, fig. 1.

[*Saturnia Montezuma* Sallé, Bull. Soc. Ent. Fr., 1856, p. xcii.]

Imago.—This species is in the antennæ and shape of the wings just as in *Telea polyphemus* except that the outer edge of the fore and hind wings are scalloped, especially the hinder ones. The ocelli are almost identical; the basal line of the fore wings is disconnected. The extradiscal black line is the same. The two apical black spots are as in *Telea*, but behind them is a white patch lined behind with brown, this shade touching the end of the extradiscal band. In the ocellus of the hind wing the clear space is smaller than in *T. polyphemus*. The outer edge is divided into seven large scallops, that on the first median vein being a little longer than the others. Expanse of fore wings 16 mm.

Geographical distribution.—Mexico.

SAMIA Hübner.

[*Samia* Hübner, Verz. Bek. Schmett. (1822?), p. 156. Type according to Kirby *S. cecropia.*]
[*Platysamia* Grote, Proc. Ent. Soc. Phila., V (1865), p. 229.]

SAMIA CECROPIA (Linné).

Plates V, figs. 4–6; VII; VIII, fig. 1; LI, figs. 3, 4; LV; LXXIV, fig. 4.

[*Bombyx cecropia* Linnæus, Syst. Nat., I, p. 447, No. 3 (1758); Mus. Ulr., p. 368 (1764); Clerck, Icones, t. 49, fig. 1 (1764); Hübn. Eur. Schmett., *Bomb.*, fig. 282 (1818?).
Attacus cecropia Drury, Ill. Ex. Ent., I, t. 18, fig. 2 (1773); Cram., Pap. Ent., I, t. 42, A, B (1775); Abb. & Smith, Lep. Georg., I, t. 45 (1797).
Hyalophora cecropia Duncan, Nat. Libr., Exot. Moths, p. 132, t. 11 (1841).—W. F. Kirby.]

Mrs. Dimmock has contributed to Psyche (IV, 276) the following historical sketch of this insect:

Harris (Rept. Ins. Injur. Veg., 1841, p. 279–280) describes the larva, imago, and cocoon of this species; later (Treatise on Ins. Injur. Veg., 1862, p. 385, 387–389) he adds figures of the larva, pupa, cocoon, and male imago; and still later (Entom. Corresp., 1869, p. 294–205) he again describes the larva. Morris (Synop. Lepid. N. A., 1862, p. 223–224)

describes larva, cocoon, and imago. Trouvelot (Amer. Nat., March, 1867, v. 1, p. 31) gives a note on the cocoon. Riley (Amer. Entom., Feb. 1870, v. 2, p. 97–102, and 4th Ann. Rept. State Entom. Mo., 1872, p. 103–107) describes the eggs and figures and describes the larva, pupa, cocoon, and male imago. Sprague (Can. Entom., April, 1870, v. 2, p. 82) describes the eggs. Saunders (Can. Entom., Oct., 1871, v. 3, p. 149–155) figures and describes the larva, cocoon, and male imago. Lintner (Entom. Contrib., No. 3, 1874, p. 125) describes the young larva. Worthington (Can. Entom., Sept., 1876, v. 8, p. 165–166) notices some color varieties of the imago. Gentry (Can. Entom., March, 1877, v. 9, p. 41–49) describes the egg, different stages of the larva, and cocoon. Grote (Can. Entom., Sept., 1878, v. 10, p. 176) says this species is double-brooded in the Southern United States. Packard (Bull. 7, U. S. Entom. Comm., 1881, p. 113) figures the larva. Neumoegen (Papilio, Jan., 1882, v. 2, p. 18) states that this species usually emerges from the pupal state about 5 p. m.; Brodie (*op. cit.*, May, 1882, v. 2, p. 83), on the contrary, states that the emergency normally takes place about 10 a. m. Riley and others state that the larva has five stages, but Wailly (Bull. Soc. Acclim., France, May, 1882, s. 3, v. 9, p. 266–267) writes that it has six stages. Brodie (Papilio, Feb., 1882, v. 1, p. 32–33) gives a list of 49 species of plants belonging to 20 genera on which the larva will feed. The genera are *Tilia, Acer, Negundo, Prunus, Spiræa, Cratægus, Pyrus, Amelanchier, Ribes, Sambucus, Ulmus, Quercus, Fagus, Corylus, Carpinus, Betula, Alnus, Salix*, and *Populus*. From other authors the following genera are compiled: *Berberis, Liriodendron, Syringa, Carya, Gleditschia, Rubus, Ceanothus, Ampelopsis, Cephalanthus, Fraxinus, Vaccinium*, and *Rosa*.

Imago.—♂ and ♀. Body brick-red, abdomen banded with white, with a lateral white line.

Fore wings gray or grizzly brown, tinged with brick-red at the base of the wing and on the outside of the basal line. The latter is gray, edged externally with black and either forming a distinct angle on the [cubital] vein or the line is a little curved. The middle area of the wing is rather dark, without any decided reddish tint. Extradiscal line brick-reddish, white toward the inner edge of the wing; the line is slightly curved outward opposite the discal spot and either slightly or distinctly scalloped. Discal spot large, semicircular, directed outwards, extended parallel with the costa; it is black on the edge, brick-red within, and white at the inner end within. It varies in size, but is about one-fifth as long as the wing itself. The grizzly black-brown shade of the wing reaches to the ocellus in cell II_2 and breaks up into a series of intracellular triangles projecting into the pale rich vandyke brown margin of the wing. These scallops frequently become detached, forming a series of black patches, the two largest of which are situated in cell median 1, 2.

The ocellus is rounded oval, almost pyriform, black, enclosing a semicircular blue line, with the sinus partly filled with pale vandyke-brown scales; a red line above the ocellus, and a reddish apical shade. Toward the costa is a costo-apical zigzag white line slightly shaded with red and composed of two large pointed scallops, and a part of a small one on the costa. A clear black-brown scalloped submarginal line, the apex of each scallop either pointed or behind the first median vein obtuse and broad and resting on the veins; this line ends in a black spot on the costa near the apex, the white apico-costal line arising from the inner end of the same black spot. Beyond this line the wing is clear pale rich vandyke brown, clear of spots and scales, and inclining to be a little deeper in tone on the edge of the wing.

Hind wings marked like the anterior ones, but with no basal line. Discal spot larger by a third, and inclosing much more white near the base, and not reaching very near the extradiscal line, which is a broad white line broadly edged externally with brick red shading into brown. Beyond is a scalloped pale vandyke brown line. This shade or diffuse line is succeeded by series of about six blackish brown elongated spots which are contracted on the middle of the inner side. Beyond are two marginal parallel lines, the outermost the fainter of the two.

Under side of the wings with more white scales, the discal spots show a greater expanse of white than above. Legs entirely brick-red.

Expanse of wings, ♂ 155, ♀ 135; length of fore wing, ♂ 76, ♀ 72 mm.

Size of discal spots on fore wings, 14 by 5 mm.; on hind wings, 16 by 6½ mm.

[*Geographical distribution.*—The records of the United States Department of Agriculture indicate the occurrence of *S. cecropia* in the following localities (the collectors' names are not given): Massachusetts (Holyoke); Maine (Richmond, Bucksport, South Lewiston); New Hampshire (Sanbornville); New York (Charlton, East Steamburg, Hillsdale, New York City, Onondaga Hill, Brooklyn, Rockville Center); New Jersey (Hammerton, Basking Ridge; Freehold); Pennsylvania (Dreshertown, Norristown, Roulette, North East, Connellsville);

Delaware (New Castle); Maryland (Faulkner, Hurlock, Baltimore, Rockville, Smithsburg); Virginia (Buckner, Lloyds, Bluestone, Robious, Fort Royal); District of Columbia (Washington); West Virginia (Wytheville); Ohio (Knoxdale, Hicksville, Dayton, Bremen, Toledo); Illinois (Alma, Mokena, Downers Grove, St. Joseph); Indiana (Coatesville, Freetown); Missouri (Reeds, House Springs, Andras); Minnesota (Winona, Duluth); Wisconsin (River Falls); Michigan (Brant, Pioneer); North Dakota (Dickinson); South Dakota (Huron, Rapid City); Iowa (Albia); Nebraska (Calaway, North Loup, Lexington, McCook, Belvidere); Kansas (Great Bend, Burlington, Emporia, Kinsley); Oklahoma (Thurston, Adair); Texas (Hockley, Galveston, Dime Box, Boerne, Flatonia); Arkansas (Fallsville, Taylor); Mississippi (Chatawa, Pascagoula, University, Holly Springs, Pass Christian); Louisiana (Collingsburg, Montgomery); Florida (Freeport); Tennessee (Limestone, Devalls Bluff); North Carolina (Wilkesboro); South Carolina (Bluffton); Kentucky (Milton); Montana (Helena). The record from Helena, Mont., was based on a specimen sent by Messrs. Child and Jones, and determined as *S. cecropia* by Prof. Comstock in 1880. The record from McCook, Nebr., was based on data supplied by Miss S. M. Le Hew, which were considered at the time (1889) to indicate *S. cecropia*. It seems possible that north of Colorado *S. cecropia* may in part invade the territory of *S. gloveri;* perhaps it has spread westward in recent years. I recently asked Prof. M. H. Swenk, of the University of Nebraska, to give me the Nebraska records for *cecropia* and *gloveri*. To my surprise he replied that there was no definite record of *gloveri* for that State, but that *cecropia* occurred throughout. His data (given July 22, 1912) are quoted in full, as they are likely to be of historic interest hereafter: "We have overwhelming evidence that this insect occurs throughout the State and is as abundant in western Nebraska as in eastern Nebraska, if not more so; in fact, in some localities it is abundant enough to be a pest on orchard and shade trees. Here at Lincoln we have found it very common and it is abundant in the vicinity of Omaha. Mr. R. W. Dawson, my assistant, tells me that he found it common in Sioux County during different years, both in Warbonnet Canyon in the Hat Creek Basin and at Glen. In 1905 at Gordon, Sheridan County, he found these larvæ very abundant, thousands of them on the trees in town, which were being badly defoliated. Looking over my economic record I find the following instances of occurrence in damaging numbers in western Nebraska: At Rushville, Sheridan County, June 17, 1908, Mr. S. B. Higgins sent larvæ, and reported it as injuring his apple trees, and stated that it had done so for two years past. At Sidney, Cheyenne County, April 24, 1909, Mr. L. Bordwell reported these larvæ as greatly injuring the trees in that vicinity. From Bigspring, Deuel County, September 13, 1908, Mr. E. F. Stevens sent specimens and said the worms were destroying his plums. From Stratton, Hitchcock County, Mr. T. E. Wellman sent *cecropia* cocoons March 7, 1910, with a statement that the insect injured plum foliage in that vicinity. From North Platte, Lincoln County, August 27, 1909, Mr. Frank Soukup sent specimens and reported the insect injuring box elders and honey locusts. September 4, 1908, Mr. F. C. Stoner sent specimens from Sunnyside, Brown County, with a statement that the larvæ were eating the foliage of his fruit trees. We have also received specimens from Blue Hill, Nelson, and Inavale, with similar reports. Along with your card requesting this information comes a letter from Mitchell, Scotts Bluff County, within a few miles of the Wyoming line, accompanied by a specimen of the *cecropia* moth for identification. If you will note these localities you will see that they embrace practically all sections of western Nebraska, and from the reports the insect is abundant enough

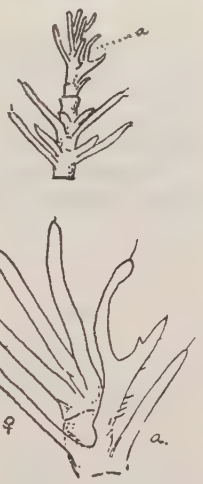


FIG. 23.—*Samia cecropia*. Details of female antenna, showing forked pectinations.

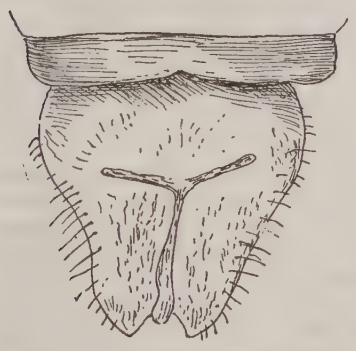


FIG. 24.—*Samia cecropia*. Female genitalia. From an alcoholic specimen.

to attract the attention of our correspondents as a pest. All of these reports have been verified by specimens."]

[Strecker in litt. reported *S. cecropia* from New Orleans, La. Dr. James Fletcher (litt., 1900) said it occurred not uncommonly from Prince Edward Island, Nova Scotia, and New Brunswick, up to the western limits of Ontario, but he did not recall ever having seen a specimen in Manitoba.]

Life history.

[The following account of the transformations of *S. cecropia* appeared in Proc. Amer. Acad. Arts and Sciences, 1893:]

From some eggs received from Mr. H. Meeske, of Brooklyn, N. Y., the larvæ hatched out at Providence during the night of June 14.

Egg.—It is large, flattened, oval-cylindrical. Length 2.5, breadth 2 mm. The shell is dull chalky white, is seen under a triplet to be pitted, but under a half-inch objective the pits are seen to be in close irregular wavy parallel rows, the pits themselves showing a tendency to be grouped into twos or threes.

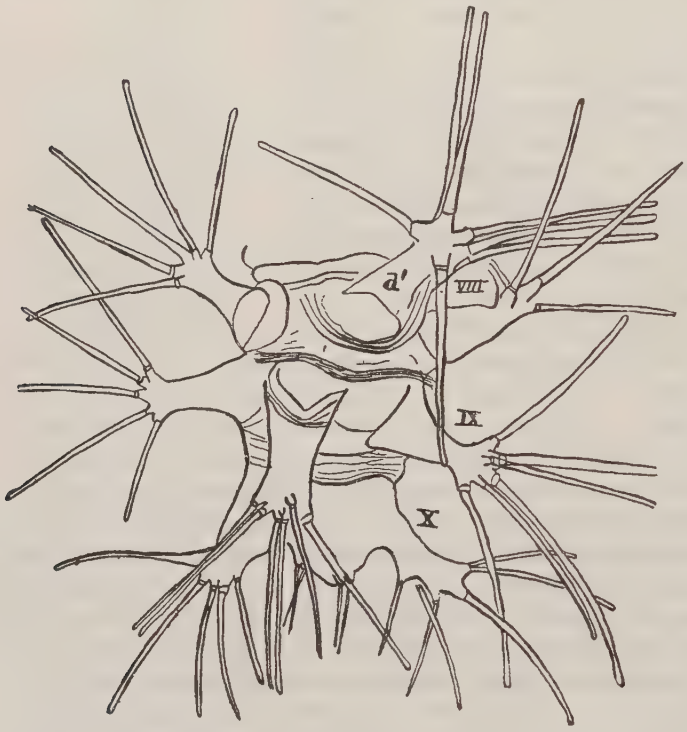


FIG. 25.

Larva.—Stage I: Length when first hatched (June 15), 6 to 7 mm. On emerging from the egg the larva is mostly black, the head, body, and hairs are jet-black, but the tubercles are pale yellowish green, the hairs or bristles they bear being black; the abdominal legs also are pale, the thoracic ones black; shortly after emerging the larva turns entirely black. One larva was observed drawing itself slowly out of the hole it had gnawed in the egg, having eaten its way through the eggshell at 11.30 a. m., June 15. It was mostly black, but the pale yellowish green tubercles were flattened down close to the body, and the hairs or setæ in each verticil or pencil were united in one pencil-like mass and bent to one side on the body. The abdominal legs were pale livid, the thoracic ones black. In 10 minutes more the tubercles had become erect, higher and longer (probably swelled out by the presence of the blood), and by this time the hairs had assumed their radiate arrangement.

In one or two minutes more, viz, from 11 to 12 minutes after extricating itself from the egg, the tubercles had all become of full length, and erect, and the black setæ, or hairs, had now spread out in a verticillate way, as normal. In an hour more the larva had turned perceptibly darker, and in three-quarters of an hour more it had turned entirely black. The spiracles, however, are yellowish green, and thus are rather conspicuous. The body is stout and thick, the head is as wide as the body. On the prothoracic segment are four dorsal tubercles, two on each side of the median line. Along the body are six rows of tubercles, each usually bearing about five radiating setæ; those of the two dorsal series are larger than the subdorsal ones. The tubercles are rather short and stout, fleshy; and are one-half to two-thirds as long as the bristles. The latter are stout, taper to one end, which under a half-inch objective is seen to be blunt, slightly bulbous, and clear, so that these setæ are evidently glandular in function; they are slightly rough with rudimentary spinules. On the eighth abdominal segment, instead of two tubercles, one on each side of the median line, as on abdominal segments 1 to 7, there is a single median tubercle, about twice as large round as those on each side, though no higher, and it is evidently the result of the concrescence in the embryo stage of two tubercles, such as are to be seen on the segments in front. It is transversely broad at base, and also bears 8 or 10 setæ, or nearly twice as many as the homologous tubercles on the other segments. The thoracic feet bear at their tips three lancet-shaped flattened acute tenant hairs; while the abdominal legs bear about 16 crotchets.

Figure 25 represents the last three abdominal segments; VIII bearing the median double tubercle *d'*, and IX the ninth pair (the right subdorsal tubercle on the ninth segment not being drawn); X the suranal plate with its armature, the two lateral tubercles, bearing each six setæ; the tubercles in front usually bear five setæ.

Figure 26. The double median dorsal tubercle of the eighth abdominal segment, showing a light median furrow, the probable line of union of what in the embryo were originally separate tubercles; it bears 10 setæ, arranged in two lateral groups of five each.

Stage II. (Described one or two days after molting.) Length 14 mm. The head now is quite small, scarcely one-half wider than the body; it is entirely black.

The body is dull dusky livid greenish; the tubercles are somewhat yellowish at base on the conical portion, but *the slender chitinous portion is shining black*, and the radiating bristles are all black; one or two of them are longer than the column or chitinous portion of the tubercle. *The thoracic tubercles are slightly longer than those on the abdominal segments*, and the single median one on the eighth abdominal segment is slightly larger than those on the seventh and ninth segments, and is now about twice as thick as those on the side, and bears eight bristles, the lateral ones on the same segment bearing five. The prothoracic segment is a little darker than the others; it bears a chitinous black plate about four times as broad as long, bearing on the front edge four setiferous tubercles of equal size, one at each end, and with two yellow spots. The tubercles in general are now long and slender, with a conical base, the stalk contracted and rather slender in the middle, the head enlarged and giving off the four or five bristles. *There are now five rows of indistinct black spots, along the body, like those so distinct in Philosamia cynthia*, but they are not distinctly seen; those of the median row are somewhat diamond-shaped. One was observed while molting, June 23. Length 15 mm., becoming 17 mm. The larva is more like *P. cynthia*, as directly after molting it is yellowish, and the five rows of black spots are now very conspicuous, the median dorsal ones being more or less diamond-shaped; but the tubercles and spines are all black. The head is black, but pale on the labrum.

In this stage, just before molting, it spins a floor of silk longer than its body, on which to stand, its crotchets being fastened in it during the process of exuviation.

On June 28, at 9 a. m., one had just molted, having been seen to draw itself out of the crumpled end of its skin. All the tubercles of the two dorsal rows are amber-yellow, except those on the second and third thoracic segments, which are a little larger than the others, and deep orange. The four prothoracic and also the two lateral rows are pale greenish, without any flesh tints. At this time both the head and the prothoracic segment are entirely pale greenish yellow, and the body is deep yellow, like that of *P. cynthia*, with the black spots very conspicuous; all the spines, however, on all the tubercles are black. The tubercles [1] are now much stouter than before, *but are not yet spotted on the sides with black, as they are later in this stage.* Its length soon becomes from 10 to 20 mm.

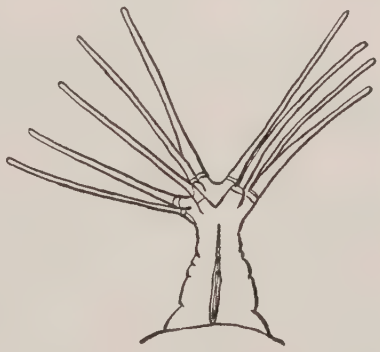


Fig. 26.

Half an hour later (9.30 a. m.) it had not changed, but by 11 o'clock a.m. the four prothoracic tubercles (rather, however, three, as the inner one on the right side is wanting, another malformation) and the second or lower lateral row had turned dark, while the upper lateral row had begun to turn dark at the base. The black patches on the sides of the dorsal tubercles had also begun to appear; also the region at the base of the antennæ, as well as the clypeus and labrum, had turned pale.

At 12.45 p. m. the black tints became more pronounced. The prothoracic spines had all turned, as well as the two lateral ones, except those on the sixth abdominal segment, which were still pale at the end. In the first or upper lateral row the tubercles were pale at the end. Of the two dorsal rows, those of the abdomen are lemon-yellow, and dusky at base, the two on the ninth segment being pale sea-green with a black patch or band on the side extending around behind. The double large median tubercle on the eighth abdominal segment is now lemon-yellow, like those in front, with a large trapezoidal black patch on the posterior half, which does not reach up as far as the origin of the black spines. The spiracles are ringed with black.

By 3 p. m. all the dark portions and markings had become jet-black; there are now 10 black spots on each segment, and the larva had now attained a length of 18 mm.

Stage III: Length 20 mm. The following is the description of this stage when fully completed, and the color of the markings fully established. The head is black, with the clypeal and labral regions green, while an irregular green band passes back from the labrum above the eyes to the side of the head, the latter being now about two-thirds as wide as the body. The larva is cylindrical, the tubercles are high and thick, the longer bristles being as long as the tubercles themselves. All the prothoracic tubercles are black; the two dorsal ones on each side being united by a black shining bridge at their base. The tubercles of the second and third thoracic segments are now deep coral-red, with black bristles; they are larger than the abdominal ones, and are very showy. The two dorsal rows of abominal tubercles are lemon-yellow with black spines, and black at the base behind and on the sides. The single median spine on the eighth segment is nearly twice as thick as the others of the same segment on each side. The two lateral rows of tubercles are black, *with the ends of a beautiful pale blue*, approaching lapis-lazuli. There are a median and two lateral rows of black spots, situated between the spines; the median dorsal series consists of two spots, one in front of the other; while the spiracular series consists of two, one in front and the other behind, but lower down than the spiracle. In some examples the body is yellowish.

[1] One tubercle on the left side of the third abdominal segment has no spines, a malformation never before observed.

The thoracic legs are black; those of the abdominal region green, but shining black on the outer side; the anal legs with a shining black patch nearly covering the outside of the leg. In one example the tubercles are aborted on the left side of the second and third thoracic and the first abdominal segments.

Stage IV. July 12, one had just moulted, the end of the body having just been withdrawn from the cast skin at 11.10 a. m. Length 25 mm. The head and prothoracic segment are green, while all the prothoracic tubercles and those of the subdorsal and infraspiracular rows are a beautiful pale cobalt blue. The two dorsal tubercles of the second and third thoracic segments are deep orange (afterwards becoming coral red); the homologous dorsal abdominal ones, including the single median one on the eighth segment, are lemon yellow. The body is tinged with blue, especially on the thoracic segments. The spiracles are white with a fine black circle, and contain a straight linear central mark. All the bristles are still long, radiated, and are black.

In this stage the four dorsal tubercles of the second and third thoracic segments are larger than any others on the body; and those on the first seven abdominal segments are of nearly uniform size; the single one on the eighth segment being nearly twice as thick.

In this stage the 8 to 10 black dorsal and lateral spots dwindle in size, becoming less conspicuous; but the black spots on the side of the head and on the sides of the abdominal legs are large and distinct.

Stage V, and last: Length 40–45 mm. One which molted about the 9th of July had a pea-green head and prothoracic segment; the head marked with a roundish black spot on each side, below which is a large black patch bearing the ocelli, and lower down a black spot. The body is pea-green, washed with cobalt blue along the back, beginning with the second thoracic and ending with the eighth abdominal segment, *and the black spots along the back and sides have disappeared.* Of the lowest lateral row of five small tubercles, the three thoracic and those on the first two abdominal segments are black; those on the third and fifth are blue at the end, but the bristles are black. All the prothoracic and the two rows of lateral (the subdorsal and infraspiracular) tubercles are cobalt blue. The two dorsal tubercles of the second and third thoracic segments are deep coral red; the corresponding ones on abdominal segments 1 to 7, and the single one on the eighth segment, are lemon yellow.

The spiracles are now white with a narrow black ring, but no central dark line. The thoracic feet are green, but black at the end. *The black spots on the sides of the pea-green abdominal feet are now obsolete;* the plantæ are bluish.

July 25–26. Some individuals were observed while molting into the last stage, their length after exuviation being 47 mm.; they became after feeding still larger. This stage differs from stage IV in *the tubercles on the first abdominal segments being much larger and more spherical than before, and orange rather than yellow,* and thus in size, color, and the spines being more like the four coral-red thoracic tubercles than the other dorsal abdominal ones.

On the first abdominal, as well as the thoracic round-headed tubercles, *there is a circle of eight black flattened knobs representing the circle of spines above at the end; also the black spines on the median eighth abdominal tubercle are much shorter and stouter than before, as are all the spines on the other tubercles.*

In all the five larvæ, except one, and in those of both stages (IV and V) the rows of black intertubercular spots have disappeared, the one retaining them (40 mm. long) having a single row of 10 dorsal black rounded spots, two on a segment, along the abdomen.[1]

On the inside of the base of the infraspiracular row of turquoise-blue tubercles is a black spot, wanting on the third thoracic, but present on the second thoracic tubercle.

Recapitulation of the more Salient Ontogenetic Features.

A. Congenital Characters.

1. The setæ in stage I blunt, slightly bulbous, and glandular.
2. The tubercles are all of the same size.
3. Body in stage I dark, almost blackish, green, head jet-black; tubercles yellowish green.
4. The homologue of the "caudal horn" shows plainly its double origin.
5. The difference between the colors of the larva of the first and last stages very marked.

B. Evolution of later Adaptational Features.

1. The thoracic dorsal tubercles in stage II and onward are longer than the abdominal ones.
2. Five rows of indistinct black spots along the body in stage II not so distinct as in *P. cynthia,* the body being still dusky green. (These do not originate from lines.) At the end of stage II the larva is more like *cynthia* of the same age, the body being more yellow, and the black spots more distinct. The spots disappear at the end of stage IV.
3. The thoracic dorsal tubercles deep orange; their homologues on the abdominal segments amber-yellow.
4. The tubercles at the end of stage II and in stage III spotted on the sides with black.
5. In stage III the dorsal tubercles of second and third thoracic segments showy coral-red. The subdorsal and infraspiracular tubercles tipped with pale blue; in stage II the same tubercles are almost entirely pale blue.
6. The head becomes green in stage IV, with a black spot on the side.

[1] This larva wants the right third thoracic tubercle, and also the right second abdominal one. In another larva of the same stage the right first abdominal tubercle is partly atrophied, half the normal size, and with only two or three rudimentary spines. These tubercles and their spines in confinement are apt to be atrophied from disease; this also occurs in *P. cynthia* and *T. polyphemus.*

7. The larva is most gaudily colored and conspicuous in the last two stages; while in *P. cynthia* there are not so marked differences between the different stages, though the last is the most variegated owing to the beautiful turquoise-blue trappings.

[The following notes on *S. cecropia* were made by Mr. J. Bridgham in 1889:]

The eggs hatched out in about 14 days, a few coming out in 12, and some as late as 18 and (it is believed) in 21. When first hatched the larvæ are moist, with hairs flattened down and tubercles like small buff-colored swellings. Within 20 minutes the tubercles have raised to high warts of a bright lemon yellow color, the black spines on them being very fine. It takes from 20 to 45 minutes from the moment the shell is first chipped for the larva to emerge. Very few have any trouble in coming out. They make the hole by biting quickly for a moment and then resting. They do this about four to six times before the hole is large enough for them to get out. No trace of the shell which they had bitten could be found inside or out of the empty egg. They eat it, but do *not* eat any more than enough to make the hole. When, in 10 or 15 minutes the tubercles become bright yellow, the larva has the appearance of being powdered with yellow pollen. The four tubercles forming the two dorsal pairs on the second and third segments and the one on the eleventh segment are the largest from the beginning. The tubercles take these shapes in the first 10 minutes. [Rough sketches are given showing the development of the tubercles when buff, bright buff, bright yellow, very bright yellow, and very bright and brilliant yellow.] For half an hour the brilliant transparent yellow color continues. It then fades *very* slowly to buff, muddy gray-yellow, very dull yellow, and finally darkens to a hard, shiny, horny black.

The cecropias were so numerous in the West that they were a pest this last season to the men who owned tree claims. They attacked the willow, the box elder, the cottonwood, and the ash. The willow produced the largest cocoons, the box elder the darkest, and the cottonwood very light-colored ones. The box elder suffered the most. A number of these western cocoons were sent to me, and they all produced large and very tawny or reddish insects. Most of them produced females. [From another note it appears that these came from Duluth and the injury to trees referred to occurred in Dakota.] The insects invariably came from the cocoons in the morning before noon. It took from 6 to 8 hours for them to fully develop. They show no signs of mating for 24 to 48 hours from time of hatching, although placed together at once. In no case did they mate during the day, but always in the early evening, the connection lasting fully 24 hours, the female clinging to some support and the male hanging free and motionless. They are not easily disturbed. Several attempts were made to mate one male with two females in succession. In two cases out of five it succeeded. All attempts, however, to mate one female with two males were in vain.

Most of the cecropias came out the first half of July. The number of eggs laid by a female was 200 to 300, half being laid within an hour or two of separation. Several females opened before impregnation showed from 250 to 350 eggs. The male *cecropia* flies in the evening. I have not had it come to the house (after females) until 9 or 10 p. m.; never in the daytime.

[A form of *S. cecropia* raised in a temperature experiment was named ab. *macula* Reiff, Zeitz. f. Wiss. Insektenbiologie, 1911, p. 235. The fore wings have near the margin a complete series or row of black spots, corresponding with those on the hind wings, while the row of black spots on the hind wings is very strongly marked. Mr. Reiff informs me that this came from pupæ collected on Long Island.]

Cocoons of *S. cecropia* were carried to Paris, June, 1900. Males appeared June 24–27, females July 4–6; eggs were laid July 7–10. Compared with a male and female raised by Fallou at Champrosay, fed on *Acer platanoides*, mine which came out in Paris showed no differences greater than between the two Fallou specimens, except that they were darker and wings more opaque. The lines and spots show no varietal differences, but the wings [in the Fallou moths] are distinctly paler. M. P. Mabille has reared three generations, a generation a year, and says there is absolutely no difference. The ♀ is paler than usual, as in those reared by M. Fallou.

SAMIA GLOVERI (Strecker).

Plate VIII, figs. 2–7; IX, figs. 1, 2; LI, fig. 1; LXVI, figs. 3, 4 (*reducta*); LXX, fig. 2.

[*Platysamia gloveri* Strecker, Lep. Rhop. Het., I (1872), p. 1.]

Imago.—Five ♂, five ♀. A slightly smaller species than *S. cecropia.* Antennæ pale as in *S. cecropia,* not so dark as in *S. columbia.* Prothorax white as in the other species; the rest of the body a little darker brick-red than in *S. cecropia* and much lighter red than in *S. columbia.* The white bands or rings on the abdomen are somewhat wider than in *S. cecropia.*

Fore wings: Apex narrower, more produced than in *S. cecropia,* and the wing is more falcate, being much as in *S. columbia.* The general hue of the wings of both pairs is wine red, not deep and rich purple-madder as seen in *S. columbia,* while there is much more wine or pale claret-red tint than in *S. cecropia,* though they are not shaded so black brown as in *S. cecropia.* The base of the fore wings within the basal line is wine red; the basal line either bent angularly or curved and rather more curved, and the white portion much broader than in *S. cecropia* and a little broader than in *S. columbia* and widely edged with black. The white extradiscal line or band straight, not sinuous, but passing obliquely in its direction across the wing; not curved outward opposite the discal spot as in *S. cecropia* and *columbia;* it is curved inward opposite the hinder end of the discal spot. It grows wider on the inner edge of the wing, and is slightly scalloped on the inner side in one example. This line is not so incurved in *S. columbia* or in *S. cecropia.*

The subapical ocellus is elongated rounded, much as in *S. cecropia,* but in some examples more orbicular, less pear shaped. The inclosed blue semicircle tends to be wider, heavier, than in *S. cecropia,* and the inclosed pale brown scales may be present or absent. The white subapical zigzag line is more as in *S. cecropia* than in *columbia,* the scallops being large, as in the former species. The apical black linear spot is more as in *S. columbia* than in *S. cecropia,* being narrow, linear.

The discal spots of the fore wings extend across the discal space and are parallel with the extradiscal line; they are much smaller than in *S. cecropia,* varying in shape and size, but in some examples much smaller and narrower, less comma-like than in *S. cecropia* and more as in *S. columbia,* they range from 6 by 3 mm. to 5 by 3 mm.; like those of *S. columbia* they are all white inside of the blackish edge and contain no red scales. In the hind wings they are shorter, less produced toward the extradiscal line than in *S. cecropia;* in this respect and in their wholly white interior they resemble *columbia.* They are also more bent or curved and less comma-like than in *S. cecropia* and less regularly oval and rounded than in *S. columbia;* the longest is 10 by 5 mm., another 10 by 6, another 9 by 4½ mm.

The series of black patches behind the ocellus are in my specimens not so well developed as in *S. cecropia* and *columbia,* there being but one present, and that in the third s. c. cell. The black doubly scalloped line is distinct and as in *S. columbia,* but the inwardly directed scallops are deeper and larger than in *S. columbia.*

Hind wings: The marginal spots differ both from those of *S. cecropia* and *columbia* in being round, small, while the line outside of them is more deeply scalloped, forming nearly complete rings, inclosing the isolated round spots; in others the spots are not subdivided in all cases, and are more as in *cecropia.*

Under side of wings of nearly the same shade as in *S. cecropia,* but there is no red at all. The discal spots, especially on the hind wings, are bordered inside the black outer edge with yellow ochre instead of the brick-red of *cecropia,* and there is no red beyond the extradiscal line in either wing. The legs are wine-red.

Expanse of wings, ♂ 142; length of fore wing, 70 mm.

Expanse of wings, ♀ 142; length of fore wing, 70 mm.

This species need not be confounded with either of its geographical neighbors, *cecropia* on the east or *californica* on the west; it is more difficult to separate it from the northeastern ally, *columbia.* This species is a much paler form than either *cecropia* or *columbia;* its prevailing tint being a claret red. It differs from both of these species in the ochreous ring in the discal

spots on the under side of the wings, and has fewer submarginal dark spots on the fore wings, and in the extradiscal line being curved in behind the discal spot, and in the discal spots of the hind wings being deeply incurved and bent. It varies in the width of the median field of the wing, which is in one nearly twice as wide behind the discal spot as in the other ♂.

It resembles *S. cecropia* in size, in the shape of the discal spots, and in part, that of the subapical ocellus, as well as the form of the discal line. On the other hand it resembles *S. columbia* in the size and shape of the discal spots, in the outer (marginal) line, in the broad white basal and extradiscal bands, in the black apical mark and in the shape of the wings.

In the venation *S. gloverii* and *columbia* are very similar. As the origin of the veins II_2, II_4, II_5 and first and second median in the fore wings are nearly identical, as a common line intersecting them will form a nearly straight line, curved neither outward or inward. On the other hand, the line thus formed in both *cecropia* and *californica* is much curved outward, most so in *S. californica*. Also in the hind wings the outer fork of the s. c. and median veins are in *gloveri* and *columbia* nearly identical, but in *cecropia* that of the s. c. is situated farther out than the other (median) while in *californica* the forks are directly opposite each other; on the whole, however, the venation in *cecropia* and *californica* is quite similar. Thus *S. californica* in its venation is so different from *S. gloveri* that it can hardly be said, as regards the venation alone, to have directly descended from or been an offshoot from it. It should also be observed that *californica* retains the short vein II_2 of the fore wings, not present in the three other species.

[*Geographical distribution.*—Ranges over the region of the Rocky Mountains, from Arizona in the south to Alberta and Assiniboia in the north. A small dwarfed form has been taken upon the high mountains of Colorado, to which Neumoegen gave the subspecific name *reducta*.—W. J. Holland. The Moth Book, p. 84.]

The most southern locality in New Mexico from which I have seen this species is Frisco, Socorro County, N. Mex. It is, however, reported by Snow as collected by Howard, and this probably indicates its occurrence in Grant County, N. Mex. In Colorado *S. gloveri* ascends to about 7,800 feet (near Ula; cf. Trans. Am. Ent. Soc., 1893, p. 356.) It breeds at this altitude; I found a cocoon from which the moth emerged June 18. In Colorado it has also been found at Rosita (Nash), Salida (Foster), Pueblo (Nash), and Canon City (Nash).—T. D. A. Cockerell in litt. to Dr. Packard November 3, 1900. (Cf. also Twelfth Report, Colorado Biological Association.)

[Also at Boulder, Colo., June 2, 1908 (A. Williamson) and May 31, 1912 (Homer Garwood).]

[The following account of the transformations of *Samia gloveri* has been kindly supplied by Miss Caroline G. Soule. She published it, with slightly different wording, in her works "Caterpillars and their Moths" (1902).

Egg period 11 days; eggs like those of *S. cecropia* in size, shape, and color.

Hatchlings.—Head shining black, round, with setæ; body black, with shining black tubercles tipped with horn-colored setæ, noticeably long and slender. Legs and prolegs shining black. They preferred young leaves of sapling choke-cherry, refusing even the tip leaves of older trees.

First molt in seven days.—Head, legs, prolegs, shining black; body dull black with shining black, spiny tubercles; the dorsal tubercles ringed with yellow at base. The horn-colored setæ gave place to long, stout, polished black spines. The first segment had a pale yellow spot. A few of the larvæ were of an orange color with black dots and tubercles. At this stage they would eat wild cherry (*Prunus serotina*), but much preferred *P. virginiana*, a marked difference from larvæ of *cecropia* and *promethea*.

Second molt after five days.—Head small, smooth, round, greenish yellow with black marks. Body greenish yellow, in some cases with black dots on the dorsal line. The tubercles on second, third, fourth, and eleventh segments were orange and black, in some cases almost black, in others orange with black spines. The other tubercles were shining black, as were legs and prolegs. The venter was smoky black.

Third molt two days later.—Head green with black marks. Body blue green on dorsum, very yellow, green below subdorsal lines and marked with black on the venter. A black line marked the rear of first segment. The tubercles on first segment were all black, or pale blue

with a black ring and top. The dorsal tubercles of all the other segments were of deep orange, changing in most cases to coral red. The other tubercles were pale blue, with more or less black. Exceptions: Some had all the tubercles black except the dorsal ones; others had all blue; others all blue with black rings; in all cases the dorsal tubercles were orange or coral red. The legs were yellow green with black tips. The prolegs either plain yellow green or with black marks. The anal plate was very yellow green. Spiracles white encircled by a very slight dark line. The shades of green varied much, and the amount and position of black marking varied more, and one or two larvæ had no black on the body and but slight marking on head and legs.

Fourth molt in six days.—Head yellow-green, large and round. Body of a peculiar dark gray-green, lighter on the dorsum, very dark on the venter, except the first segment which was light yellow green like the head. Dorsal tubercles all yellow with shining black spines, the others pale blue with black rings. Legs green with black tips, prolegs very yellow green, spiracles white.

In this stage they gave out a strong odor like camphor, and still refused all leaves but those from the tips of saplings. This was a marked characteristic, for most larvæ prefer older leaves after the second molt. In this stage they were very delicate, and many died without apparent cause. They fed for 16 days, then slowly spun their cocoons. The male moths were polygamous and mated freely with *angulifera* and *promethea* as well as and after mating with their own species. The moths are the most restless and excitable saturniids I know, the females protruding the ovipositor before their wings were half spread after emerging, and they were slow in developing. Some moistened the end of the cocoon before emerging, others seemed to push through it without any "opener."—Caroline G. Soule.]

[The following on *S. gloveri* was published by Dr. Packard in Proc. Amer. Acad., XXVIII, p. 65:]

Young larva, just hatched.—May 15. Just as it slips out of the egg, the body and head are jet black, but the spines are white, though their tips at the origin of the hairs are black. In a few moments, however, the spines turn jet black; the hairs arising from them being white.

[The following notes were found among Dr. Packard's MSS.:]

Eggs from Miles City, Mont.; sent June 6, 1893, [larva] described June 14, length 6–7 mm. Head about as wide as body, shining black; body dull brown-black; tubercles all black, with pale gray hairs; dorsal, thoracic, and those on last three segments of abdomen a little larger and longer than those on abdominal segments 1 to 7, the dorsal ones on eighth abdominal segment a little larger than the others. Thoracic legs shining black, abdominal legs dull livid brown. Spines black-brown, with pale ring around the base.

[Larva] July 26, 1901, from Joutel; stage IV, length 39 mm. Head apple green, not spotted; six prothoracic spines turquoise, the two dorsal rows of tubercles, second and third thoracic, abdominal 1–7 and median one on eight segment, bright orange red, but yellow on basal third; all tubercles of lateral rows, and the dorsal ones on ninth and tenth abdominal segments turquoise, including those on suranal plate; spiracles light pale luteous, with a narrow black ring.

SAMIA COLUMBIA Smith.

Plate IX, figs. 3–6; X, fig. 1; LI, fig. 2; LVIII, figs. 1, 2.

[*Samia columbia* Smith, Proc. Boston Soc. Nat. Hist., IX (1865), p. 343.]

Imago.—Six ♂, six ♀. Several others also examined. Antennæ dark purple-madder, those of the male not so broadly pectinated as in *cecropia* or the two other species. Body very hairy, of a rich dark purple-madder; hinder part of the thorax and base of hind wings vandyke brown. Prothorax white; abdomen broadly and conspicuously ringed or banded with white in ♂ and ♀, the white bands being wide in ♀. The fore wings are slightly less rounded at the apex and more falcate than in *S. cecropia* and the size smaller.

Wings of both pairs much darker than *S. cecropia*, being of a rich dark purple madder-brown; while the lines or bands corresponding to the white or those tending to become white in *S. cecropia* are broader, more distinctly and conspicuously white, and contrast more with the rest of the wings.

Fore wings at base rather bright reddish madder extending to the broad white distinct basal band which may, as in *S. cecropia,* be either angulated on the median vein or regularly curved; it is narrowly shaded with black externally. Extradiscal band white, the edges dark, with no reddish externally as in *S. cecropia.* It is slightly excurved opposite the discal spot, and is slightly scalloped, varying in the degree of curvature and in the distinctness and completeness of the scallops. The median area between the two bands is dark purple madder but not so rich and clear a madder tint as at the base of the wing. Beyond the extradiscal band the wing is densely powdered with black. The row of five black submarginal patches behind the ocellus as in *S. cecropia,* there being three of them, one in median cells, 1, 2, 3, respectively, which are larger and more distinct than the others. The black, sinuous submarginal line situated as in *S. cecropia,* but quite different in the scallops being arranged in pairs, each half separated by the end of a vein; there are four of these double scallops. The line extends toward the apex and costa connecting with the costo-apical black spot, which is narrower, linear, not broad, triangular and diffuse as in *S. cecropia.* The costo-apical white line is as in *S. cecropia,* being composed of two scallops varying somewhat in distinctness.

The discal spot in the fore wing is narrow, oblique, not so parallel with the costa as in *S. cecropia,* but with the extradiscal line in six examples; it is white, usually edged with reddish, and the reddish shade is bordered externally with black, but in one out of six examples the red is wanting in both pairs of wings. The discal spots vary much in shape, from an oval (5.10 by 4 mm.) to an elongated kidney shape, and to a long narrow mark measuring 6 by 2 mm.

In the hind wings the discal spot is of the usual comma shape, the apex or outer end not extending so near the extradiscal line as in *S. cecropia.* It varies from being broad short ovate (6.10 by 5 mm.) to an elongated and narrow spot (7 by 3 mm.) or larger (11 by 7 mm.).

The subapical ocellus is regularly rounded oval at each end; it is black, the contained pale blue semicircular line varying in being a half circle, or tending to reduction in one ♂. Its hollow is partially filled with pale vandyke-brown scales, which in some examples are rarely wanting (in one ♂ there are only five or six of these brown scales). Between this ocellus and the costal edge is a gray bluish patch or discoloration growing whiter toward the zigzag white line. (This whitish patch is much less distinct and smaller than in *S. cecropia,* while it is wanting in *S. gloverii* and *californica.*)

In the hind wings the marginal markings of the outer edge are much as in *S. cecropia*; there is however no red shade beyond the extradiscal line, this area being black-brown. The submarginal series of seven spots are as in *S. cecropia,* but much darker, the line beyond is narrow and definite, rather more distinctly scalloped than in *S. cecropia,* and the edge and fringe are darker, vandyke-brown, than in *S. cecropia.*

Under side of wings darker than above, grizzly black-brown, with no shades of madder, and the markings are more distinct and whiter, contrasting with the rest of the wing. In the subapical region of the fore wings there is less red than in *S. cecropia.*

The extradiscal lines on the under side are white edged within with black; the discal spots are broadly edged with black, and with reddish ochreous within. Legs dark madder-purple.

Expanse of wings (bred specimens), ♂ 83–95 mm.; length of fore wing, ♂ 43–52 mm.

Expanse of wings (bred specimens), ♀ 93 mm.; length of fore wing, ♀ 48 mm.

The variation of the discal spots in this species is especially noticeable, their shape and size not being so constant as in *S. cecropia.* The subapical ocellus is rounder, more as in *S. gloveri* than in *S. cecropia;* on the under side the blue semicircle tends to become irregular and sinuous. That this eye-spot is only a modification of one of the intracellular series behind is well seen in this species, where these spots are quite closely developed.

Dr. James Fletcher informs me that the Manitoba form "is much redder than our eastern form," referring to those occurring in Ontario.

Judging by the imago and its geographical distribution this is a melanotic offshoot of *S. gloveri* which has, since the glacial epoch or since the climate of the region it inhabits has become what it is, been transformed into a fixed species. It is an inhabitant of a cooler and

damper climatic region, and has not been known to occur south of it, though overlapping on *cecropia* territory.

The black and white shades and dark rich purple hue predominate; there are no brick-red tints as in *S. cecropia*. The subapical ocellus is small and the discal spots smaller. As in some other alpine and subarctic Lepidoptera, such as *Platarctia hyperborea* (*parthenos*), black and white and shades of madder-purple predominate.

[Dr. James Fletcher (litt.) wrote that he had *S. columbia* from Ottawa, Almonte, and London in Ontario.]

James Fletcher writes the United States Department of Agriculture from Central Experiment Farm, Ottawa, June 24, 1898: "I may say that the food plant of *columbia* [*nokomis*] in the West is the Silver Bush, *Elæagnus argentea*. The experiment that I have been anxious to

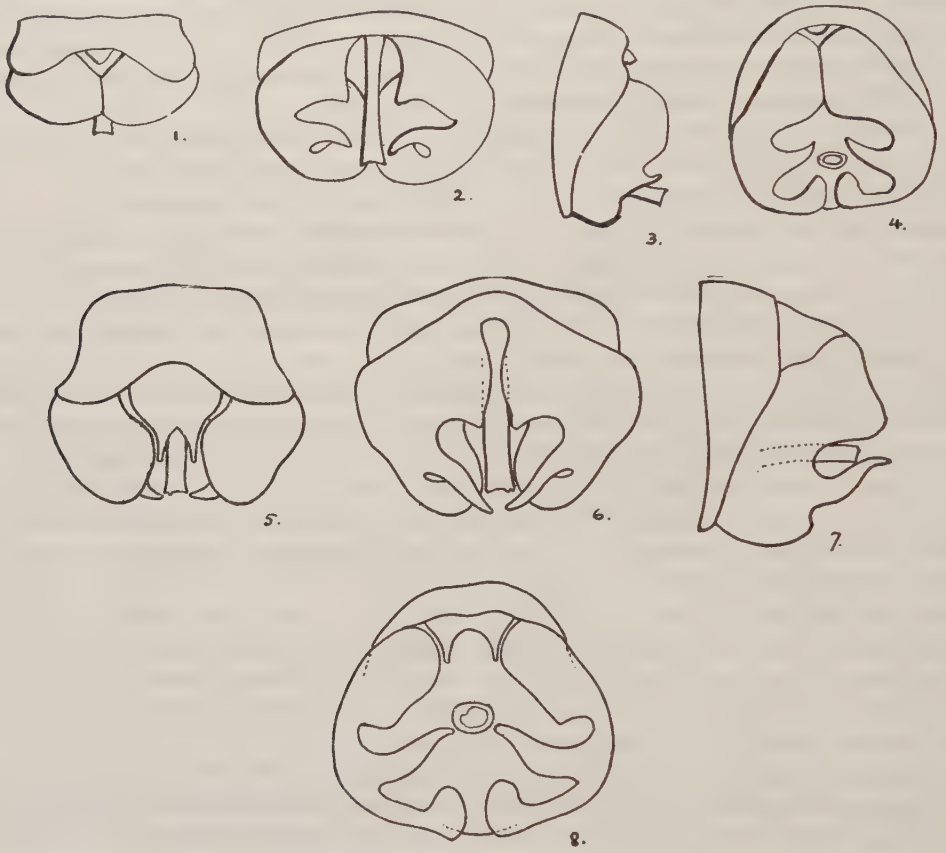


FIG. 27.—Male genitalia. *Samia columbia;* 1 (dorsal view), 2 (ventral), 3 (lateral), 4 (posterior view). *Samia cecropia;* 5 (dorsal view), 6 (ventral), 7 (lateral), 8 (posterior).

get eggs for was to see if eggs laid by the Manitoba form, *which is much redder than our eastern form*, would feed on larch."

Eggs of *columbia* by *columbia* are much smaller than eggs of *columbia* ♀ by *cecropia* ♂ (Joutel). Crosses of *columbia* ♀ and *cecropia* ♂ fed on wild cherry went through changes much more rapidly than those on larch, and were a great deal larger.

[Mr. J. Alston Moffat has published the following on *S. columbia* in the Canadian Entomologist, 1894, pp. 281–283:

During the winter of 1891–2, I received from Miss Morton, of Newburgh, N. Y., six cocoons of *P. columbia*, which she had reared from ova, received from one of her correspondents in Ann Arbor, Mich. They were the first cocoons of that moth I had seen. Their extremely small size, as compared with *cecropia*, their natty appearance and dark color, relieved by flecks of white silk, was quite novel to me, so I frequently showed them to visitors. Amongst these was Mr. R. Elliot, of Plover Mills, one of our members, whose residence is about 15 miles northeast of London, and whose name is well known in ornithological circles, but who is rather a "naturalist" than a "specialist"; clear, calm, and

appreciative in his observations of nature, and thoroughly reliable in his statements. When he looked at the cocoons, he meditatively remarked: "I think I have seen somethimg like that about our place. Indeed, I feel certain I have seen it, but I shall keep a lookout." On the 14th of April, 1894, I received from Mr. Elliot two *P. columbia* cocoons. They were attached to a branch of larch, on opposite sides of the same branch, and one about half its length in advance of the other. The son of a neighbor of Mr. Elliot found one on a tree growing at his house and showed it to Mr. Elliot, who saw it was what he was on the lookout for, so they searched the trees and found more.

The roughened exterior of the cocoons, their dark brown color, with white markings, give them such a close resemblance to the bark of the branch, that, but for their prominence, they would be extremely difficult to detect, thus forcing on the observer the conviction that larch must be their natural food-plant. On the 3d of May a male moth emerged from one of the cocoons, and on the 6th a female from the other. On the 5th of May Mr. Elliott gave me another cocoon, which gave forth its imago on the 13th, also a female. The male is 3½ inches in expanse of wings; the females are 4 and 4½. Those from Miss Morton's cocoons are of corresponding dimensions.

Much doubt was entertained when this moth was first discovered as to whether it was a "species" or a cross between two. This question was conclusively settled when Prof. Fernald published his description of its early stages (Can. Ent., Vol. X, p. 43). Miss Morton has succeeded in pairing it with *cecropia*, and she says the progeny "were all barren and quite different from either parent." When the professor wrote his description he was not confident that it was distinct from *gloveri*. Since then Miss Morton has reared *columbia* and *gloveri* side by side, and she says: "The difference between their larvæ is marked in all their stages, whilst the cocoons also differ in size and texture." But she considers *columbia* to be closer to *gloveri* than to any other of the genus, and she has had large experience in rearing all of them. It is known by those who have handled them to be an easy thing to separate *columbia* cocoons from all the other Platysamias, but there seems to be some difference of opinion as to what especially distinguishes the moth from *cecropia*. That *columbia* varies somewhat with the locality where found seems certain. The Quebec and Maine forms, as lllustrated by Bowles and Strecker, do not strikingly resemble the Michigan specimens, which, Miss Morton says, are quite constant in general appearance. Prof. J. B. Smith states that all the *columbias* that he has seen are very much alike. I sent a specimen from Miss Morton's cocoons to Dr. Brodie, of Toronto, who has given *columbia* a good deal of attention, and he said it did not much resemble any *columbia* he had; and if he had received it without data, he would have pronounced it a dimunitive *cecropia*. This to me was decidedly confusing, and set me wondering if there were no points of difference whereby to separate the two species unmistakably.

When taking a general survey of the two moths, the attention is at once arrested by the smaller size and darker color of *columbia*. But there are gradations in these. A very small *cecropia* is at times obtained. The male from Mr. Elliot's cocoons is extremely dark, whilst a female received from Miss Morton does not perceptibly differ in general shading from some *cecropias*. So, single specimens could give no certain indication from these differences.

With six authentic *columbias* before me, and several fresh examples of *cecropia*, I will take up that part of Prof. S. I. Smith's original description, where he contrasts the two species, and comment upon it in sections.

"This species differs materially from *S. cecropia*. The male has the antennæ, palpi, thorax, and legs much darker." Correct, as a rule. "The short gray (or whitish) band on the hind part of the thorax is not found in S. *cecropia*." I have a male *cecropia* with an indication of it, and in one of the *columbias* it is not visible. "The discal spots of all the wings are white, instead of dull red with a white center." In one of the *columbias* the spots are quite red. "The transverse bands of both pairs of wings are white, instead of dull red bordered internally with white." Here, I think, we get the most distinguishing point of difference between the two moths. There is no symptom of red in the bands of *columbia*. The "narrow white transverse band," which in some of the specimens would be better termed a line than a band, shades externally into the dark gray of the border, whilst internally it is edged with solid black, which merges into the dark brown of the middle area. This appears to me to be the most conspicuous and constant difference between the two species, and would of itself make it quite easy to separate the moths, regardless of size or depth of coloring. "It wants the broad white band so conspicuous on the anterior border of the secondaries of S. *cecropia*, and also the reddish tints and markings near the apices of the primaries." The band is not so clear a white, or so broad, but is edged with black, which is absent in *cecropia;* the tints on the apices are a distinction of degree, and but a slight one at that.

"The female differs from that of *S. cecropia* in having the palpi, legs, and abdominal rings dark brown, or almost black, instead of dull red." One of the *columbias* is not distinguishable from *cecropia* in that respect. "The discal spots of the primaries are linear, obscure, and parallel to the transverse band, instead of broad, conspicuous, and parallel to the costal border." The spots are more linear, but with a decided tendency toward lunate, thereby being about as much in line with the costal border as with the transverse band. And so far from being obscure, from the absence of red in them, they are more conspicuous than in *cecropia*. There is a male *cecropia* before me that would answer that description better than any of the *columbias*. "The discal spots of the secondaries are small and almost round, instead of large and somewhat triangular." No difference except in size, and the absence of red in the spots of *columbia*. "As in the male, it has the white on the hind part of the thorax, and wants the white on the anterior border of the secondaries, and also the red on the apices of the primaries, on the discal spots, and on the transverse bands." What I have said on these parts of the male answers also for those of the female.

So, then, the only points that are left to me whereby to unmistakably separate *columbia* from *cecropia* are the narrow dull white transverse band edged internally with black and the total absence of a red band.]

[Mr. Pergande notes that in 1891 Mr. J. W. Allis sent cocoons of *S. columbia* from Adrian, Mich., with the statement that some years almost all of the pupæ are killed by woodpeckers.]

[SAMIA COLUMBIA NOKOMIS (Brodie).

Originally described as *Platysamia columbia nokomis* in "The Biological Review of Ontario," October, 1894 (cf. Canad. Entom., 1908, p. 354). The early stages are described by W. J. Freedley, jr., in Canadian Entomologist, XL (1908), pp. 350–354. Dr. James Fletcher (litt. to Dr. Packard, 1900) thus refers to *nokomis*:]

There is a form found all through Manitoba and the west as far as the Rocky Mountains, shaped exactly like *columbia*, and which passes under that name, but it is a much redder and handsomer insect, as red as *gloveri* all over the disc, and very much the same tone, but of the same shape and size as true *columbia*. * * * The larva feeds on *Elaeagnus argentea* [i. e., *Lepargyraea argentea* (Nuttall) Greene]; "75 to 80 per cent of the larvæ, unless collected very young, are attacked by a tachinid fly."—(E. F. HEATH, litt., 1901.)

SAMIA CALIFORNICA (Grote).

Plate X, figs. 2–5; XI, fig. 1; LI, fig. 5; LVIII, figs. 3, 4.

Saturnia ceanothi BEHR, Proc. Cal. Acad. Sci., 147, 1855.
Saturnia euryalus BOISDUVAL, Ann. Ent. France, III, 2 sér., XXXII, 1855 (no descr.).
[*Platysamia*] *californica* GROTE, Proc. Ent. Soc. Phil., V, 229, note, 1865.

[This species is now generally known as *Samia rubra* (Behr), Proc. Calif. Acad. Sci., I (1855), p. 46. This name has priority over *ceanothi* and *californica*.]

Imago.—Three ♂, five ♀. Size small, about that of *S. columbia*. Male antennæ large and with long hairy pectinations, slightly larger than those of *S. cecropia;* in the female toward the end the distal lower pectinations are one-half as long as the proximal ones; in color reddish brown. Body and wings quite uniformly light brick-reddish madder-brown, less purplish madder than in *S. gloveri*. Prothorax white; rest of the thorax and abdomen reddish brown, not showing the different shades of color seen in *S. columbia* and *gloveri;* ♂ abdomen scarcely or not banded with white above, but with a white lateral line, and whitish beneath.

Fore wings as falcate as in *S. gloveri*. Basal line distinct, broad, white, bent or curved on the median vein, either with (♂) or without (♀) a black edge on the outside. Extradiscal line straight or slightly sinuous, being a little curved outward opposite the discal spot and very slightly curved inward behind the discal spot. It is slightly scalloped, varying in degree of scalloping. All the wing within the extradiscal line is uniformly of a warm subochreous, pale madder-brown; but beyond, two-thirds of the way to the outer edge it is a rich subroseate pale madder-brown, and in the Oregon ♂ it is pale purple madder. Subapical ocellus round or elliptical; the blue semicircle distinct, rather short or tending to disappear; in one ♀ it is only present on the costal side of the spot, and in another it is still smaller, on the verge of disappearing. Apical spot black, edged with red, and from its inner end proceeds the zigzag white line with the scallops of the same size as in *S. gloveri*. The area of the wing within this line is washed with lilac and white scales.

The discal spots vary much in shape and size, but those in the hind wings are inclined to be longer, narrower, and more produced than in *S. gloveri* or any of the other species, in one ♂ reaching the extradiscal line. Those of the fore wings either wide or narrow and parallel with the extradiscal line, or oblique and parallel with the costa, while the ends are much attenuated—drawn out into a white thread. The following measurements will indicate the varying size and shape: One ♂, discal spot of fore wing, 10 by 3 mm.; one ♀, 7 by 3 mm.; another (♀), 9 by 4 mm. Discal spot of hind wing in one ♀, 15 by 3 mm.; and in another ♀, 12 by 5 mm.

The series of dark blotches situated half way between the extradiscal line and the outer edge of the wing, present in *S. cecropia* and *columbia*, is wanting in *S. californica*, but in one ♂ it is in part represented by a series of triangular pale brown madder scallops of the outer edge of the submarginal pale reddish madder shade. The edge of the wing beyond is pale vandyke brown. The submarginal distinct black-brown line is scalloped, as in *S. gloveri*, but

it varies; in one ♀ the scallops are large, and the sinus between them is deeper and narrower than in the other species, while in the two other examples (♂ and ♀) the line is only slightly scalloped; thus in the third subcostal cell, where in one ♀ there are two large scallops, with a deep narrow triangular inward-pointing sinus between them, in another ♀ (from Olympia, Oreg.) the line is not scalloped at all, unless we except a very slight indentation.

The submarginal row of intracellular spots are of the same general shape as in the other species, being however pale brown madder, while the two marginal lines are all dark brown, as in *S. cecropia*.

Under side of wings as above, but a little paler, the white bands whiter, more pronounced, and the discal spots edged more markedly with black. There is more white in the area beyond the extradiscal line in both wings. The subapical ocellus and white subapical zigzag line and black costal spot are as above.

Expanse of wings, one ♂, 103 mm.; length of wing, 50 mm.

Expanse of wings, ♀, 100–130 mm.; length of wing, 48–60 mm.

This species shows a greater tendency to variation than any of the other species. This is shown in the absence of, or when present the shape of the discal spots, the color of the ocellus, the extradiscal line, and the variation in the submarginal dark scalloped line.

In Mr. Joutel's collection is one without any discal spot in the fore wings. In one ♀ the subapical ocellus is light reddish madder, concolorous with the shade beyond the extradiscal line.

The Oregon example has a beautiful roseate tint not seen in the California example; it is a little darker and the discal spots wider. The outer shade of the extradiscal line is of a rich roseate purple madder. These differences in color I should ascribe to the cooler more rainy region it inhabits, compared with the drier territory of California.

Whatever may be said as to the origin of the other species, there seems good reason to suppose that the Pacific coast species (*californica*) was the last to diverge from the generic stock, as it is the most divergent of the four species.

[*S. rubra* was sent to the Department of Agriculture from Chesley, Idaho, by Mrs. D. A. Bishop in 1900; the specimen was determined by Dr. L. O. Howard.]

Eggs.—A batch of eggs was received from Mr. J. T. Grundel, Alma, Santa Clara, Cal. They were received and some had hatched out July 1, and the following description was drawn up July 2, 1897:

Larva.—Stage 1: Length 5 mm. Body and head entirely jet-black, with no markings whatever. The hairs arising from tubercles are brown or horn color.

The dorsal tubercles of the three thoracic and eighth and ninth abdominal segments are considerably larger than those of abdominal segments 1–7. The hairs are as long and some of them a little longer than the tubercles themselves. Spiracles whitish, distinct, but minute. The tubercles are longer and slenderer than in *S. cecropia*, and the hairs are shorter in proportion to the length of the tubercles.

On July 12 the larva had doubled in length, measuring 10 mm., but it had not yet cast its first skin. It had slightly changed in color. On abdominal segments 1 to 6 the base of the tubercles of the dorsal and lateral rows is beeswax yellow. This period is represented by Mr. Joutel's figure.

July 15, either in the evening or before 9 a. m. of the 16th, the caterpillar had molted. The following description was made at 10 a. m. of the 16th:

Stage II: Length 11–12 mm. Head black, labrum yellow, body now all straw-yellow; all the tubercles and spines black. On the hinder edge of the prothoracic segment is a transverse black line, interrupted on the median line of the body. Mesothoracic (second) segment spotless except a lateral dot; third thoracic segment with a wide triangular black dorso-median spot on the front and hind edge, and abdominal segments 1–10 with two similar low wide triangular distinct black dorsal spots; and two subdorsal and two lateral spots; of the lateral spots one is above (in front) and one below (behind) the spiracle, this lower one being the longest

and largest. The abdominal tubercles are but little smaller than the thoracic and eighth abdominal dorsal tubercle. Along the ventral side of the body is a row of large black linear spots on each side.

The following stage was described from some larvæ hatched from eggs, kindly sent by Mr. Jacob Doll, June 23, 1897. The caterpillars preferred wild cherry leaves to those of the apple.

Stage III: The larva had molted twice. Length 25 mm. Of the same shape as *S. cecropia*. Head a little over half as wide as the prothoracic segment, apple green, a pair of pear-shaped black spots on each side of the head opposite the apex of the clypeus, a spot at the base of each antenna and one at each side of the labrum. The six prothoracic tubercles turquoise-blue, with black spines; the two median dorsal tubercles of the second and third thoracic segments straw-yellow, while the lateral ones are turquoise-blue, as are the abdominal ones; all the spines black; in Joutel's figure all the dorsal abdominal tubercles are salmon colored or yellow. The simple median tubercle on the eighth abdominal segment yellow, with black spines, while the two dorsal tubercles on the ninth and tenth abdominal segments are turquoise-blue. The body along the back is pale turquoise-blue, green on the sides. Spiracles white, narrowly ringed with black.

Thoracic legs yellow, tipped with black.

Abdominal legs green, concolorous with the body, becoming yellow at the end.

The dorsal tubercles of the second and third thoracic and first abdominal segments are larger than those on abdominal segments 2–9, the latter being all of the same size. The edge of the suranal plate is tinged with straw-yellow.

The larva of this species is very different from that of *S. cecropia* of the same stage; the head is green instead of black, and there is no black bridge between the dorsal prothoracic tubercles, and all the tubercles are either blue or yellow, not coral-red, and with no black on them, only the spines being black. The tubercles of the lateral row are *all* blue, with no black on them. There is neither a median nor two lateral rows of black spots between the tubercles, such as characterize the larva of *S. cecropia* at this stage.

In one example the spines are more or less imperfect, tending to become atrophied. One out of six or seven others fed on the wild cherry; on July 12 it was still in stage I, but had grown to the length of 10 mm.

[SAMIA RUBRA, subspecies.]

[J. W. Cockle (Entom. News, July, 1908, p. 340) describes a local race occurring in the interior of British Columbia, the general color of which is purple-brown above on all the wings, while the under side is always grayish.][1]

CALLOSAMIA Packard.

[*Callosamia* Packard, Proc. Ent. Soc. Philad., III (1864), p. 379.]

[Dr. Packard has a marginal note in pencil:]

Compare with *Philosamia*. Male divergent, female conservative.[2]

CALLOSAMIA PROMETHEA (Drury).

Plate XII; XIII, figs. 1–3; XLIX, fig. 3; LXIX, figs. 3, 4; LXX, fig 1; LXXIV, fig. 2.

[*Attacus promethea* Drury, Ill. Ex. Ent., II (1773), pl. 11, figs. 1, 2; pl. 12, figs. 1, 2.]

Moth.—Male (four examples, and others observed). Body and wings dark brown; abdomen not banded with white. Fore wings uniformly dark vandyke brown from the base to

[1] [Two distinct new varieties or races are represented in the National Museum:

(1.) *S. rubra kasloensis*, collected by Dr. H. G. Dyar at Kaslo. This is the form described by Mr. Cockle, as indicated above. It is a submelanic race, darker above than typical; much blacker and less red below.

(2.) *S. rubra cedrosensis*, marked "Cedars I." (evidently Cedros I.), Mexico. Male. Margins of upper side of wings broadly and suffusedly blackened, the submarginal markings almost entirely lost; ocellus of primaries smallish; discal mark on hind wings longer and more slender than in *kasloensis;* beneath the wings are very black, but the region basad of the bands is suffused with brownish vinaceous.]

[2] [Dr. W. T. M. Forbes notes that *Callosamia* differs from *Samia* by the presence of vein R_3 in anterior wing, and the alternately longer and shorter pectinations of female antennæ.]

the extradiscal line. Basal line either very faint or obsolete; it is situated nearer the discal spot than the base of the wing. Extradiscal line narrow, pale brown, of the same color as the margin of the wing and crossing the outer third of the wing; it is irregularly scalloped; between the costa and the third cell or origin of II_4 [III_4 revised nomenclature] is a single outward curve, and the line is not bent back on the costa toward the middle of the wing as in *C. angulifera;* behind this bend the line is scalloped on each vein, the deepest scallop being the one between veins [IV_1 and IV_2 revised nomenclature], one in second median cell. Discal spot a slight small trigonate pale discoloration, varying in size and shape, and in one ♂ entirely obsolete; but when present nearly touching the extradiscal line. Beyond this line the wing is a little paler, the outer edge of this transverse shade irregularly scalloped, two of the scallops in the third and fourth II cell respectively like those in *S. cecropia,* which forms distinct black spots or blotches, while the scallops in the succeeding cells are more or less distinct. Outer margin of the wing clear, unspotted pale vandyke brown, and containing the distinct scalloped marginal dark brown line, which is doubly scalloped, the sinuses between them broad and deep, three of them are doubly scalloped, while the last one is less prominent.

Subapical ocellus round, black, the blue semicircle distinct and the hollow partly filled with pale brown scales. Above and below the ocellus cell II_2 is stained with reddish, especially next to series II_2 and II_3. The apical black mark is wanting in this genus. The subapical white zigzag line is oblique; composed of two scallops pointing outward and two inward, and the line ends directly above the ocellus, the first or costal scallop nearly touching the submarginal reddish line which sweeps around and connects (being a part of) with the post-ocellar brown line (this reddish line in one example is quite deeply scalloped), at the mouth of the sinus thus made is a whitish patch.

Hind wings twice as long as the abdomen along their inner edge; with the discal spot either very small and faint, or obsolete; extradiscal line faint, well scalloped, and curved around, ending on the outer one-fourth of the inner edge of the wing. Outer edge of the paler brown shade deeply scalloped, the points of the scallops being intervenular and ending near the series of dumbbell-shaped dark-brown spots, which in one example are separated into two, forming a series of two spots in each cell. This series is bounded externally by the scalloped submarginal line.

Under side of wings paler than above, and there is a greater contrast in hue on the fore wings between the basal, median, and submarginal portion of the wing; the discal spots are more distinct, definite, and trigonate, and in the hind wings they are very long; the angle is in the upper part of the cell. The zigzag line in the hind wings is more distinct and the scallops are more pointed than on the upper side.

The median space is washed with lilac beyond the extradiscal line, as on the upper side of ♀, and the line is white, being much more distinct than above. Submarginal spots reddish, more of the shade of the upper side of the ♂. The apex is colored and marked much as above.

Expanse of fore wings, 80–102 mm.; length of fore wings, 36–49 mm.

Female.—Antennæ about two-thirds as wide as in ♂. Differs from the ♂ in its body and wings being of a brick-red lilac hue, the darkest portion of the wing being of a brick-red brown or burnt-sienna brown. Basal line well marked, broad, diffuse, dull whitish, edged externally with black-brown, especially in the discal space. Extradiscal line as in ♂, but more deeply scalloped, shaded within with black. Discal spot minute, faint, the shade beyond irregularly scalloped as in ♂, and the submarginal line as in ♂, so with the subapical ocellus and the reddish areas. The short apical white line ending on the ocellus is divided into $3\frac{1}{2}$ scallops, the largest of which is nearest the apex, the two next behind pointing inward, the half scallop being an incomplete one and forming a short line parallel with vein II_2. Hind wings with a faint basal line, the extrabasal line more sharply scalloped than in ♂; beyond as in the fore wings. The wing is much lighter in hue, becoming more brick red toward the irregularly scalloped outer edge of the brick-red transverse shade. The series of submarginal brick-reddish spots very distinct, and they are nearly all undivided. The submarginal line beyond is dark brick-red-brown. The ocellus is a little rounder than in the ♂, and the blue

semicircle is shorter and indistinct. The discal spot is small, irregular, one-half as large as in *C. angulifera* (length 5 by 2½ mm.).

The under side of the wings with the same hues as above, but decidedly brighter; basal line wanting, faintly showing through from above. Discal spot of the same size as above, minute, triangular, but more distinct. The markings of the wing beyond the extradiscal line the same as above. The ocellus differs in the sinus made by the blue semicircular line being filled in with pale brown scales concolorous with the margin of the wing. Hind wings within the extradiscal chestnut brown, being of a darker and wider brown than on the upper side, but the tint beyond this line is the same as above.

Discal spot of the same irregular shape as above, though more distinct.

Expanse of fore wings, 81–102 mm.; length of fore wings, 44–51 mm.

In five females from Rhode Island (H. L. Clark collection, Museum of Brown University) there is considerable variation in size and color. Two of them closely approximate *C. angulifera*, though still much less ochreous; the others are dark, being brown inside and deep red brick, with a slight lilac tint on the broad shade beyond the extradiscal line. The outer edge of this shade is zigzag alike in all, and the submarginal line is the same. The discal spots are smaller, in one example those on the fore wings are reduced to an indistinct triangular discoloration; in all the others the spots are tolerably distinct, while those on the hind wings are quite uniform in size and shape. The distance between the extradiscal and basal lines does not differ materially. There is considerable variation in the scallops of the extradiscal line in both pairs of wings, in one ♀ being much as in *C. angulifera*. There is some variation in the degree of falcation of the fore wings. The subapical ocellus varies somewhat; in one ♀ it is 3 mm. in length, in another 6 mm. being twice as large, while the blue semicircle is much longer and the brown scales may be either absent or quite thick.[1]

[*Geographical distribution.*—In the records of the United States Department of Agriculture, *C. promethea* is reported from the following places; Massachusetts (Malden, Sudbury, West Groton); New Hampshire (Winchester, Chester); New York (Albany); New Jersey (Holly Beach, Hammerton, Vineland); Pennsylvania (Germantown, Pittsburgh); West Virginia (Gerrardstown); Virginia (Newport News); Alabama (Lowndesboro); Arkansas (Bentonville); Michigan (Detroit); Ohio (Toledo); Illinois (Manchester); Missouri (Cadet). Holland states that it ranges from southern Canada to Florida.] "Very abundant in western Ontario, and at any rate as far [east] as here (Ottawa)." (J. Fletcher, litt., 1900.)

Life history.

The larvæ are at first gregarious, feeding side by side on the underside of the leaf.

Egg.—Oval-cylindrical, somewhat flattened; the surface pure white, somewhat shining. Under a half-inch objective the shell at first seems to be entirely smooth and shining, without any markings, with neither pits nor polygonal areas, but after further observation very faint, irregular, moderately large polygonal areas, with faintly raised edges or boundaries, can be detected. Length 1.8, breadth 1.5 mm.

The egg of *C. angulifera* is the same as *C. promethea* in shape and color, though mine are slightly smaller, and the polygonal markings appear to be even fainter than in *C. promethea*.

In the Attacinæ the eggs present generic, specific, and perhaps varietal characters; this of course depends on the structure of the lining of the oviduct, and it may be asked what natural selection or the influence of external surroundings have to do with the differences in the shape, structure, and markings of eggs.

Larva.—Stage I. Described a few hours after hatching. Length, 5 mm. The head is wider than the body in the middle, and as wide as the prothoracic segment; black, with a broad transverse whitish band crossing the clypeus, including the apex and a large portion of the clypeus itself, the labrum and base of the antennæ pale. The thoracic tubercles, at first lemon-

[1] [Ab. *caeca*, nov. ♀. Discal marks on upper side of both pairs of wings reduced to nigrescent shades, without any pale area. New York (H. Burnett). U. S. National Museum.]

yellow, become afterwards dusky greenish, while those of abdominal segments 1 to 7 are lemon-yellow; all give rise to black bristles, the longer of which are *about twice as long* as the tubercles themselves, being much longer than in the other Attacinæ of the same stage, while the tubercles themselves are smaller in proportion. The thoracic tubercles bear seven or eight, and the abdominal six bristles, one of which is often longer than the others.

The body is lemon yellow, very conspicuously banded crosswise with black. The prothoracic segment is yellow; dusky along the front edge; or yellow with one or several black spots; on the hinder edge is a broad black transverse band ending on the lowest lateral tubercle, which is yellow, and a little larger than the dorsal ones on the same segment. The front and hinder edges of each succeeding segment of the body are black. The anal legs have a large black spot on each side. The three tenant setæ on the thoracic feet are broad and lancet-shaped, and there are 16 crotchets on the abdominal legs.

The single median tubercle on the eighth abdominal segment is evidently double in its origin, being twice as broad as long at the base, and there is a median space between the two sets of setæ, there being two tops or crowns, from each of which arise five setæ; and it is larger than the others, its greatest diameter being the transverse one. This and the two dorsal and lateral tubercles on the ninth and tenth segments (suranal plate) are dusky or blackish green, and are of the same hue as those on the thoracic segments, and *they are a little larger* than those on abdominal segments 1 to 7, those being yellow. All the bristles are jet-black, and there are none of any other color. They are finely spinulated, the spinules rather dense; they taper to the acute end, and are clear and probably glandular. It is to be noticed that the body is transversely banded with black; that the dorsal tubercles of the three thoracic and the last two abdominal segments are already in this stage differentiated in color and size from those of the first seven abdominal segments; indeed, the larva is much variegated, being showily banded, with great contrasts of color.

Mr. Bridgham's specimens of stage I were observed on July 15, and were fed on the sassafras and wild cherry. The second stage was drawn on July 23.

Stage II. Length, 10 to 12 mm. The head is not quite so wide as the body behind the middle, being much smaller in proportion to the body than before; it is black, with a sinuous broad conspicuous *whitish* (not yellow as in stage I) band passing across the clypeus, so as to include the apex, and curving down toward the antennæ. The ground color of the body is *whitish* instead of yellowish, so that the transverse black bands, though narrower, are more conspicuous than before. On the first thoracic and ninth abdominal segments are two dorsal and two lateral black tubercles, one as in stage I but on all the other segments except the tenth abdominal the tubercles are now yellowish with black spines; all the tubercles are situated on the white portion of the body, the black bands being situated between them. The single median tubercle on the eighth abdominal segment is now *yellowish*, and distinctly seen to be double, being very broad, and each side provided with a crown of about five spines. There are five or six spines to each tubercle, and many *are black, and much shorter and stouter than in the previous stage*, the outer ones being about as long as the tubercles bearing them are high, the central inner one longer. The round black spot on the side of the anal leg differs from that in stage I in being curved, boomerang-shaped. The thoracic legs are black, and the abdominal ones pale yellowish. *In this stage the dorsal tubercles on the second and third thoracic segments are of the same size and color as those of abdominal segments 1 to 7; the differentiation in size and color of the four thoracic tubercles having not yet taken place.* It is to be observed that in stage I the dorsal tubercles on all these thoracic segments are black, and the median one on the eighth abdominal segment is also black.

Bridgham's figure and Riley's specimen, from which the foregoing description has been drawn up, agree with Riley's description.

Figure 28 represents a dorsal view of the last four abdominal segments (VII–X) with the medio-dorsal tubercle (*d'*) on the eighth uromere (VIII), bearing 10 setæ, two of them arising one on each side of the median line: *a*. a seta from one of the dorsal tubercles on the ninth

segment; *b*, one from the seventh segment showing the medullary fluid supposed to be the poisonous secretion, though there is no secretory cell visible at the origin of the spine; the spine is dark and rather opaque.

Stage III. (Described from an alcoholic specimen in the author's collection.) Length, 15 mm.; with of head, 2 mm. The head is marked in general as before, but the hairs are smaller and less numerous. *The sinuous white band in front is much wider than before,* being in front fully *three times as wide as the black line* connecting the eyes; the band being narrower on the sides above the eyes. The head is much narrower than the body, which is now stout and thick. *The two transverse black bands or rings on each of the thoracic and abdominal segments have now disappeared,* only faint traces of them being left here and there, the most persistent traces being a minute linear black spot situated on the side behind the spiracles. The prothoracic tubercles are black, and about half as long and large as the second and third thoracic dorsal ones, which are whitish, with a black ring at base; the lateral ones being black-brown. *All the dorsal abdominal tubercles are but a little smaller than the thoracic ones, and all, both dorsal and lateral, are black-brown,* except the single large dorsal tubercle on the eighth segment, which is now very large and fully twice as thick as the largest dorsal ones elsewhere, if not more; it has four spines on each side, and two central ones. In all the tubercles the spines are now short, and no longer than the thickness of the tubercles bearing them. The black curved line on the side of the anal legs is now *more curved than before.*

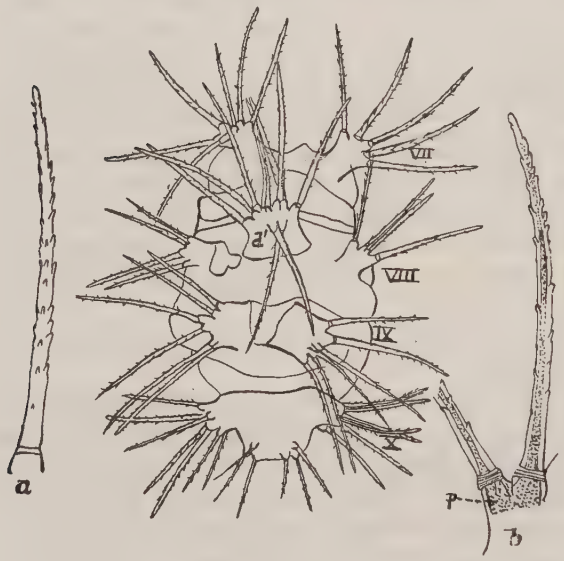


FIG. 28.

Stage IV. (Described from Mr. Bridgham's colored sketch.) Length, 20 mm. *The head is now yellow,* with two black dots in front, and a narrow black transverse line connecting the eyes and antennæ; the head is about two-thirds as wide as the body, which is now whitish. The tubercles on the prothoracic segment are black, and of the same size as those on the abdominal segments, *the latter (dorsal ones) being now about one-half as long and large as those on the second and third thoracic segments;* the single median dorsal one on the eighth segment being a little thicker, and colored sulphur-yellow (Riley), like those on the second and third thoracic segments.

The curved black line is slenderer than in stage III. All the legs, both thoracic and abdominal, are pale yellowish.

Stage V, and last: Length 45–50 mm. In its final shape, the body is cylindrical, tapering toward each end, and not so stout and thick as in *Samia,* or *Telea,* or *Actias,* or *Attacus,* and the tubercles are smaller, smoother, and without the conspicuous large spines present in the genera named, while the dorsal abdominal tubercles are smaller than in any other genus of Attacinæ known to us. In its larval characters the genus is the last and most specialized of a series beginning with *Saturnia* (*S. carpini*) and including *Samia* and *Philosamia.*

The head is small, being a little less than one-half as thick as the body, and now is without any black spots. The black dorsal prothoracic and abdominal tubercles *are much shorter than in stage IV.* The dorsal prothoracic ones are mere black spots, not even rising into low warts; the two lateral ones on each side are much larger than the rudimentary dorsal ones, rising into low conical shining black tubercles no higher than wide. The homologous lateral tubercles on thoracic segments 2 and 3 are larger and more prominent than those on abdominal segments 1 to 7. The rudimentary black dorsal tubercles on abdominal segments 1 to 7 are low rounded conical shining black bosses, which are transversely oval at base, and not so high as

wide. The four dorsal second and third thoracic tubercles, together with the single median one on the eighth abdominal segment, are all of the same size seen sideways, but the last-named tubercle seen from in front or behind is thicker, owing to its double origin. The two dorsal ones on the ninth abdominal segment are rather high, being long, conical, but no higher than the median single one on the eighth segment. All the legs are yellowish; each of the middle abdominal legs with a black dot in the middle of the outer side.

Prof. Riley has briefly described and in part figured in his Fourth Missouri Report (p. 121) the five stages of this larva, and my material confirms his description. Mr. Dyar, however, claims that from his observations there are but four stages. For the colors, since we have not yet seen the living larva, we must quote from Riley, who states that in the fifth stage "the appearance is totally changed; the body is of a most delicate bluish white, with a faint pruinescence." Further on he says: "As this worm acquires its full growth, the pruinescence mentioned above disappears, and it acquires a more greenish cast, except around the base of the tubercles, where there is a more decided blue annulation." In Psyche for June, 1891, M. Beutenmüller gives a detailed description of *six* stages, *five* molts. His fifth and sixth stages appear to be the same as our fifth.

[*Food plants.*—Tulip tree (Pergande); sassafras (C. V. Riley). Dr. C. V. Riley's notes include the following: "C. S. Minot says that it feeds on barberry, birch, cherry, maple, sassafras, azalea, and even arbor-vitæ at a pinch; and that is preyed upon by an Ophion, an Ichneumon, and a Tachina."]

CALLOSAMIA ANGULIFERA (Walker).

Plate XIII, figs. 4–6; XIV, figs. 1–5; XLIX, fig. 2; LXIX, fig. 2.

[*Samia angulifera* Walker, Cat. Lep. Het. Brit. Mus., V (1855), p. 1224.]

Moth.—Male. Antennæ usually with the paler distal pectinations decidedly shorter than the dark or basal ones.

Body and base of the wings more ochreous than in ♀ *promethea.* Basal line as in *C. promethea.* Extradiscal line more ragged, irregular and more deeply incurved between the costa and vein II_3, the sinus in second median cell deeper than in *C. promethea.* Wing beyond as in *C. promethea,* but rather deeper ochreous in one and dusky brown in two others. Discal spot very large, trigonate, oblique, T-shaped, the outer arm of the T in one male not so well developed as in ♀, not reaching the extradiscal line; it extends from vein II to median. In all the males this spot is not so wide and heavy as in females. Subapical ocellus as in *C. promethea* ♀, as is the white apical line, and also the marginal line.

Hind wings above much as in *C. promethea,* but either more ochreous or rich chestnut brown within the extradiscal line; the scallops of this line nearly the same, but the line tends to end nearer the hind angle of the wing, especially beneath. The marginal series of spots ochreous. The outer edge of the broad ochreous shade beyond the extradiscal line in both wings ends in more decided, sharper triangular scallops on the veins than in the female of *C. promethea.* Discal spots large, expanding each way on the median vein, and reaching vein II_1, the outer point not reaching to the extradiscal line. Beneath the tints are decidedly more ochreous than in the ♀ *promethea;* the base of the hind wings is not dark chestnut, but in one ♂ is deep ochreous. Extradiscal line whitish, beyond washed with pink.

Expanse of fore wings, ♂ 87–105 mm.; length of fore wings, 46–54 mm.

Two males from Providence, R. I. (Clark collection), are quite dark, one being more so than the other. One approaches, within the extradiscal line of both wings, the dark hue of *promethea* ♂, and the wing beyond the extradiscal is dark brown, with the outer pointed scallops very distinct; the spots of the submarginal series are present in all the cells, but in the three hindermost cells the spots are divided into separate round or oval or pyriform spots. The discal spots in the hind wings of one ♂ are nearly obsolete, only the ends being present; in the other ♂ the spot is present, though not so large as in the ♀ of the same species.

The apical zigzag white line is not so definitely marked and the points between the scallops are not so sharp as in the ♂ of *C. promethea*. In one ♂ (Clark collection) from Rhode Island the discal spot of the fore wing is slender and elongated and pierces clear through the extradiscal line.

It thus appears that the ♂ *angulifera* varies in its degree of resemblance to *C. promethea* (being in one similar in hue to ♀ *promethea*) but generally much darker, the tints being chestnut brown, and approaching ♂ *promethea*, but still differing notably, especially in the fact that the shade beyond the extradiscal is decidedly lighter than in *C. promethea*. No case of a decided intermediate form has yet been found.

Female.—Wings broader, not as falcate as in the ♂. Body and wings ochreous, much more so than in ♀ *promethea*, with a pink or lilac tinge beyond the extradiscal line and at the base of the hind wings. Fore wings with the white basal line distinct, edged externally with black, but the line is diffuse. Extradiscal line more deeply scalloped and the points between the scallops sharper than in the ♂ of *promethea*, and the line is bent more, ending nearer the middle of the wing than in ♀ *promethea*.

The scallops of this line on the hind wings are deeper, more marked than in *C. promethea*. The discal spots in both pairs of wings are usually much larger than in *C. promethea* ♀, being trigonate T-shaped, extending from vein II to median, either not reaching or extending clear through the extradiscal line. The two lines (extradiscal and basal) vary in distance apart. The submarginal line and spots of the hind wings are much as in *C. promethea*, those in the anterior part of the wing being broken up into seven separate spots, with two dumbbell ones behind.

Subapical ocellus as in ♀ *promethea*, but slightly smaller than in two ♀ *promethea*. The white apical line as in the ♀ of the other species. Beneath, the wings are chestnut red on the basal half, especially of the hind wings. Almost exactly like a ♀ of *promethea*, but usually it is more ocherous beneath.

Expanse of wings, ♀ 96–104 mm.; length of wings, 49–55 mm.

While the ♀ differs mainly in color, being more ochreous, and the discal spots larger, the ♂ differs still more; and yet the two forms might be considered as varieties, or *angulifera* an offshoot of *promethea*, were not the larvæ so distinct.

Has *C. promethea* originated from *C. angulifera, and is it phylogenetically the younger of the two forms?*

In 1897 Mr. A. G. Mayer, to use his words in Psyche, February, 1900, showed that the "melanic color of the male of this moth is phylogenetically newer than the color-pattern of the female."

I have also independently supposed that this must be the case. The melanic male of *C. promethea* is paralleled by the dark male of *Saturnia pavonia-minor*, and which I have instanced as a case of female preponderance, or gynerhophy. The facts regarding the latter case are set forth above. In this case we have four species, one of which differs from the three others in having a male with darker fore wings and deep ochreous hind wings, forming a striking departure from the typical style of coloration in the other three species. In the present case we have in a genus with two species only a wide departure not only in coloration but in the shape of the wings.

Life history.

The larvæ hatched on July 6 and 7 from eggs kindly sent me by Miss Morton, and fed on the leaves of the tulip tree, stages II to IV, are described from Mr. Bridgham's colored figures. Miss Caroline G. Soule describes the five stages in Psyche, Vol. V, p. 260.

Egg.—Of the same shape and color as those of *C. promethea*, though slightly smaller, while the polygonal markings appear to be even fainter than in *C. promethea*.

Freshly hatched larva.—Length 4 mm. The head is black, with two lunate ochreous yellow spots on the vertex, while in front, on the middle, is a transverse, pale parchment-colored stripe, and in front of this stripe is a transverse clypeal line of the same pale hue. The body is pale

ochreous yellow, and the hairs appear to be of the same color; the two faint transverse lines on each segment being nearly obsolete, so that in some specimens they are not apparent, and the body does not appear to be striped with black, as is so plainly the case in *C. promethea.*

Compared with *C. promethea* of the same stage, the larvæ of the present species are rather smaller, and differ decidedly, the body being much paler, and not heavily striped with black, the transverse black bands, so broad and deep black in *C. promethea,* being much narrower, very much fainter, and often nearly obsolete; also all the tubercles and hairs, except those on the prothoracic and sometimes the tenth abdominal segments are pale yellowish, like the body. The tubercles and setæ on the prothoracic segment are not so dark as in *C. promethea.* The upper pale stripe on the head is a little narrower than in *C. promethea.* The black stripes on the last three abdominal segments are somewhat heavier than those in front. The tubercles on the ninth abdominal segment and the end of the anal or tenth segment may be dusky, while the dark stripes on the segments in front may be entirely wanting.

There is little difficulty in separating the larvæ of the two species at the first stage. It is noteworthy that the colors of the dorsal tubercles are not so much differentiated as in *C. promethea,* as they are in a degenerate stage; the dorsal tubercles of the second and third and the first and seventh to ninth abdominal segments are not dark, as in *C. promethea,* but like those on segments 2–6. The dorsal tubercles are a little slenderer, and the setæ or hairs rather longer, than in *C. promethea.* The tubercles have the same number of setæ as in *C. promethea,* the single one on the eighth abdominal segment having 10 setæ, and being distinctly divided into halves. There is no black patch on the side of the anal legs, it being well marked in *C. promethea,* and the thoracic feet are considerably paler.

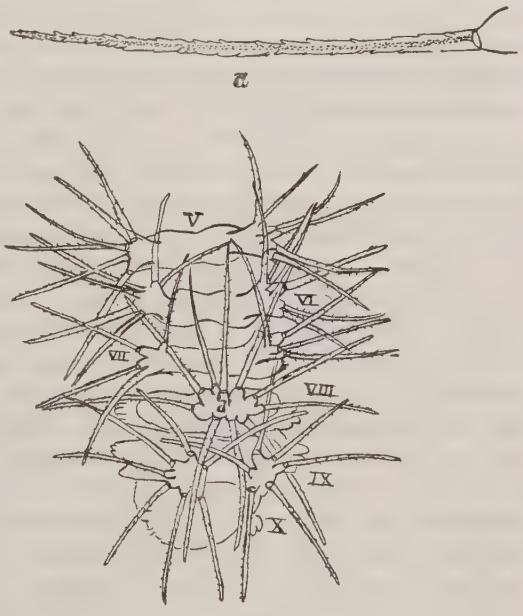


FIG. 29.

This stage was drawn at Providence, July 8; the second, July 13; the third, July 15; the fourth, July 19; the fifth, July 26; the larva becoming fully grown August 1.

Figure 29. The last six abdominal segments (V–X) of *C. angulifera,* which should be compared with the camera drawing of the same parts in *C. promethea* to show how different the shapes of the tubercles are, the setæ also differing in the two species at the same stage. The setæ on the suranal plate have not been drawn. The setæ are transparent; *d'*, homologue of the "caudal spine" of Sphingidæ; *d*, a seta enlarged.

Stage II: Length 8 mm. The body is now longer in proportion than before, and the head is now no wider than the body. The head is black, and striped with whitish yellow the shape and width of the pale stripes nearly as in stage I. The prothoracic segment has black dorsal tubercles, and the black transverse dorsal band is divided into two patches, situated behind the tubercles. The tubercles are now shorter than before, with shorter bristles, and those on the second and third thoracic, and the first, eighth, and ninth abdominal segments, are slightly, but not very noticeably, larger than before. The larva differs markedly from that of *C. promethea* of this stage in the faint, narrow transverse stripes, those of *C. promethea* being still heavy and dark. There is no curved black spot on the side of the anal legs; the thoracic legs are much paler than in *C. promethea.* The body is greenish yellow, while the ground color of *C. promethea* is more of a whitish hue. Only the two last abdominal tubercles (on tenth segment) are dusky. (The figures of Mr. Bridgham agree with Miss Soule's description.)

Stage III: Length 12 mm. The head now differs in being less black, the pale bands being wider, and there are two white spots on the vertex, one on each side. The body is pale straw

yellow, more distinctly banded with black than before, the two heaviest and broadest bands being on the hinder edges of the prothoracic and the eighth and ninth abdominal segments, while the suranal plate is blacker than before, with a lateral black line. On the other segments, the black bands (two to each segment) are confined to the back, and do not extend down the sides. All the tubercles from the second thoracic to and including the ninth abdominal ones are yellowish.

At the end of this stage, length 18 mm. The body is rather thicker than before, and whiter yellow; the head with more white, especially on the vertex, and the white stripe across the middle is rather wider. The second and third thoracic, first, eighth, and ninth abdominal dorsal tubercles are not distinctly larger than the others, and all are paler. The black stripes are nearly as before, but perhaps not quite so heavy. The suranal plate is not so black as before, but with two black spots; and *on the side of the anal plate is a black elongated patch.*

Stage IV: Length 34–35 mm. The characters of the fully grown larva are now nearly attained. The head is large, three-fourths as wide as the body, pale lemon-greenish, with six black dots, two below, and one above. The two dorsal prothoracic tubercles yellowish; the lateral ones black. The two dorsal tubercles on the second and third thoracic segments are now high, large, and with obsolete spines, red, with a black base or ring (Miss Soule says, "black at base, ringed with yellow, orange at tips, smooth"). The single one on the eighth abdominal segment is ringed with black at the base, and beyond yellow; it is slightly smaller than those on the thoracic segments. All the other dorsal as well as lateral tubercles are now reduced to low small black rudimentary tubercles. In this stage it differs from that of *C. promethea* of the same stage in the much shorter black tubercles on the second to seventh abdominal segments; and in the dorsal tubercles on the second and third thoracic segments being reddish, instead of yellowish. The curved horseshoe-shaped black line on the side of the anal legs is the same as in *C. promethea.* The "yellow stigmatal ridge" noticed by Miss Soule is shown in Bridgham's figure.

Full-grown larva.—Length 68 mm. On comparing a blown specimen of *C. angulifera* with one of *C. promethea* the former differs in the following particulars. The head is slightly larger, without the two black dots in front and the lateral dot, and without the broad black stripe extending in *C. promethea* from each side of the base of the labrum upward, and ending on the side of the head below the lateral dot. The four dorsal black spots on the prothoracic segment are wanting in *C. angulifera,* and the short lateral tubercles are not colored black as in *C. promethea,* while the tubercles themselves are much smaller and less prominent. The four dorsal tubercles (two on the second and two on the third thoracic segment) are decidedly smaller and slenderer than in *C. promethea;* the tips are black where those of *C. promethea* are yellow, and the black ring around the base is narrower than in *C. promethea.* The two lateral small black tubercles on each of these segments are wanting, and all traces of them have nearly or quite vanished. Of the dorsal ones I can with difficulty, by means of a good lens, find faint traces. they are so nearly effaced.[1]

There are in *C. angulifera* no black spots on the base of the four pairs of middle abdominal legs, and there is a black ring only on the lower side of the anal legs, as in *C. promethea.* The suranal plate has two transverse linear black spots on the ends, but none of the other black markings of *C. promethea.* It wants the pair of triangular black sternal spots situated in front of each pair of thoracic legs of *C. promethea.* The median dorsal horn on the eighth abdominal segment is black at the base and tip. The two dorsal black tubercles on the ninth segment. and the lateral ones, are wanting, though they are conspicuous in *C. promethea.*

C. angulifera is much duller in color and much less ornamented, with shorter, less conspicuous tubercles, and all, both dorsal and lateral, on abdominal segments 1 to 7 are wanting. It seems to be a form which may be regarded as having originated later than *C. promethea,* and which has diverged from it, and it seems to be a species which has directly evolved from the stem-form *promethea.*

[1] These tubercles have evidently disappeared owing to disuse. What there is in its habits to bring this about is a matter of conjecture; this form is only known to feed on the tulip tree, and this may be a case of arboreal selection; the change of food plant, together with possibly the abundance of food, this tree having but few species of larvæ feeding on it, may have had something to do with the abolition of the tubercles.

[CALLOSAMIA ANGULIFERA CAROLINA F. M. Jones.]

Plate LIX, figs. 11 and 12.

[Described in Entom. News, 1908, p. 231. Type locality Berkeley County, South Carolina. In Entom. News, 1909, p. 49, is a description of larva, and figures of moth and cocoons. The insect is here called *Callosamia carolina*.]

Recapitulation of the more Salient Ontogenetic Features of Callosamia.

A. Congenital Features.

1. Hatched with heavy black transverse bands on a yellow body, and the head black, banded with yellow; the bristles moderately long; thus the larva is already a rather conspicuous object.

2. The dorsal thoracic tubercles already differentiated in size and color from those on abdominal segments 1 to 7. The differences between the freshly hatched larva and the last stage very marked; more so than in *Platysamia* or *Samia*.

B. Evolution of later Adaptational Features.

1. In stage II the body becomes paler, and thus the black bands more conspicuous. The second and third thoracic dorsal tubercles and those on abdominal segments 1 to 8 are now all yellowish, and of the same size.

2. Disappearance in stage III of the transverse black bands. The abdominal tubercles all become blackish.

3. In stage IV the head becomes yellow, being less conspicuously marked, and the dorsal abdominal tubercles are about half as long and large as those on the second and third thoracic segments.

4. The body becomes in the last stage much smoother than before, the dorsal prothoracic and abdominal tubercles being much shorter than in stage IV. This reduction of size and inconspicuousness of the dorsal abdominal tubercles is carried out to excess in *C. angulifera*, where they become obsolete, and the larva is simply a large green caterpillar with inconspicuous markings, and simply protected by its green color, like the majority of lepidopterous larvæ; not being so strikingly marked as in the fully fed *Philosamia cynthia*.

[EUPACKARDIA Cockerell.]

CALLOSAMIA CALLETA (Westwood).

Plate XL, figs. 2–5; XLIX, fig. 1; LXIX, fig. 1.

[*Saturnia calleta* Westwood, Proc. Zool. Soc. Lond., 1853, p. 166, pl. 33, fig. 2.
Samia calleta Walker, Cat. Lep. Het. Brit. Mus., V (1855), p. 1225.
Attacus calleta J. B. Smith, Proc. U. S. Nat. Mus., IX (1886), p. 422.
Callosamia calleta W. F. Kirby, Syn. Cat. Lep. Het., 1 (1892), p. 750.
Eupackardia calleta Cockerell, Entom. News., May, 1912, p. 228.
Platysamia polyommata Tepper, Bull. Brooklyn Soc., V (1882), p. 66, pl. 1, fig. 3.]

Male.—Antennæ as in *C. promethea*. A white posterior thoracic band is present (absent in *C. promethea*).

Fore wings less falcate than in *promethea* ♂, but more falcate than in ♀ of that species; uniformly dark Vandyke brown within the extradiscal white band. Discal spot regularly trigonate, white, of the same shape and size in both wings, the angles attenuated, a little prolonged; it is intermediate in size between *C. angulifera* and *promethea*. The extradiscal line forms a wide white band, even slightly sinuous, not wavy or scalloped; beginning on the outer fourth of the costa, where it curves outward, the line ends near the outer third of the hind inner edge, curving inward and extending along the inner edge of the wings; the line is narrowly edged externally with red. The fine brown submarginal line is not deeply sinuous, as in the two other species, but only very slightly so; beyond it the edge of the wing is pale.

Subapical ocellus larger than in *C. promethea*, longer, and widely bordered externally with madder-red. This is followed by a series of about four blue semicircles or fine lunules, one in each of the four hinder intervenular cells. (These blue lunules are not present in the two other species.)

Hind wings colored and marked as in the anterior pair, but of the two submarginal brown lines or bands, the inner is wide and broken into two more or less connected spots in each cell, the outer narrower line being continuous. Underside of the wings just as above, the ocellus and the blue lunules are distinct, and all the markings and bands are the same.

Venation: Differs from the two other species in the origin of veins II_3 [III_3] and the four succeeding on fore wings being (if connected by an imaginary line) in nearly a straight, only slightly curved line, this line being in the two other species much curved, especially in *C. angulifera*. For these and other differences in both pairs of wings see the figures.

[A note in pencil is as follows:] Is vein II_2 wanting? This and the presence of four blue lunules are primitive characters, and the other two species have no white thoracic band.

Expanse of fore wings, ♂ 112 mm.; length of fore wing, 57 mm.; length of body, ♂ 28 mm.

This species differs decidedly from ♂ *promethea* in the less falcate wings, in the distinct broad, unscalloped, slightly sinuous even white band, in the presence of the white trigonate discal spots, in the much less sinuous submarginal line, while the hind wings are not so much prolonged, being in shape more like the ♀ of the other two species.

The specimen described (from United States National Museum) differs from Tepper's figure (photograph) of the ♀ in the common extradiscal band being so even, not waved or undulated; in the submarginal line being less sinuous, in the discal white spots being much more regular and distinct, in the more falcate fore wings, and the prolonged hind wings.

[Ab. *semicæca*, nov. ♀. Discal spots on hind wings totally absent, those on fore wings very small. Jalapa, Mexico (Schaus). In the male the spots on hind wings may also be practically absent.]

Life history.

A lot of 25 eggs kindly given me by the Sydney Ross Co., New York, through Mr. C. B. Riker, had hatched several hours before their receipt on June 6, from eggs laid May 21, 1903.

Egg.—Oval cylindrical, somewhat flattened; chalky white; the surface seen under a powerful lens to be minutely pitted. Length $2\frac{2}{3}$ mm.; breadth about $1\frac{3}{5}$ mm. The hole eaten by the larva for its exit is situated at the end of the shell, but sometimes encroaches on one side.

Larva.—Stage I. Length 6 mm. The body tapers slightly toward the end. The head is as in *P. cynthia*, being smaller than in *C. promethea*, and with no pale band; velvety black-brown; clypeus-posterior a little paler; clypeus-anterior pale gray or dull livid whitish; the head bears a few scattered black hairs. The body is blackish brown and all the setæ are black-brown, being of the same hue all over the body.

The first thoracic segment bears six tubercles, of which the lowest one is a little larger than those of the row above, and the two median dorsal ones are slightly smaller than those on each side. They are well developed, higher than in *C. promethea*, and nearly as in *P. cynthia*. The tubercles of the three thoracic and first abdominal segments of the same size and height, those of abdominal segments 2–7 a little smaller; all are about twice as long as thick; the longer setæ are fully twice as long as the tubercles bearing them; those on the second thoracic to seventh abdominal segments are a little curved. Each dorsal tubercle bears 10–11 setæ, several arising some distance below the crown; all are of unequal length and thickness; those on the mid-abdominal segments 7–8 in number. The median dorsal tubercle on eighth abdominal segment is twice as thick and considerably higher than those next to it.

Suranal plate with two tubercles higher than broad; this and segments 9 and 10 and all the legs, both thoracic and abdominal, are brown-black.

The body is black-brown; all the segments are ivory white on the posterior edge (the first and second thoracic less so than those behind), and the front edge of the white transverse band

makes two scallops on each side. Front edge of each segment dark, but the base of each tubercle is surrounded by white.

It moulted June 11, all the individuals casting their skins simultaneously, just as all were observed to hatch at the same or nearly the same moment.

Stage II: Length 11–13 mm. The body is rather thick and the thickness uniform. The head is not nearly so wide as the body. It is peculiar in shape and color, rather deeply bilobed; the surface soft velvety black-brown, apex of the clypeus pale greenish; between this triangular spot and the eyes is a deeper yellow roundish spot, and behind each group of ocelli is another long yellow mark; clypeus-anterior white, labrum black.

The body is armed with large, rather high tubercles, all nearly of the same size, though those of the second and third thoracic segments are very slightly larger than those on the abdominal ones, and that on the middle of the eighth abdominal segment is nearly twice as thick as those on the seventh segment.

On the prothoracic segment are four large high tubercles of equal size and height, but slightly smaller than those on the second and third thoracic segments, each with four stout spines and four smaller ones. All the tubercles are fleshy and stand up like columns, and are about twice as high as thick. The median tubercle on the eighth abdominal segment bears twelve setæ arranged six on each side of the crown; those on the ninth segment with four large setæ.

Suranal plate with two large erect tubercles from a third to a half smaller than those on the ninth segment, and bearing five large, long, and five finer setæ; farther back near the end are two small low tubercles bearing from two to three coarse, and two or three finer bristles. Anal legs with setiferous tubercles on the hind edge.

The body is uniformly deep ochreous yellow. The first thoracic segment is prussian or dark steel blue, but yellow on the hinder edge, with a yellow spot on the side, or the segment may be all yellow except around the base of the tubercles; the other segments are yellow. Suranal plate and anal legs of a rich dark steel blue. On the front edge of each segment (thoracic 2–3 and abdominal 1–8) there are three dorsal triangular black-brown spots which are usually connected by a black line along the suture; behind these spots on each segment is a similar black line dilating into three triangular spots which vary in being either connected or separate. Spiracles dark, on a dark ground. Both thoracic and abdominal legs black; underside of the body blackish.

In this stage the markings are much as in *C. promethea*, i. e., the two transverse black bands, but they are farther advanced or more specialized, and the head is without the transverse pale band in front; the prothoracic and other tubercles are the same. They are of the same general proportions, but in color *C. calleta* is darker, especially beneath, and on the suranal plate and legs *calleta* has longer bristles.

End of stage II: When about to molt (May 26) it is 23 mm. in length. The head in my example was very small, and is just as described in stage II, but with traces of another yellow spot. At this time the body is much less spotted and marked with black-brown. The first thoracic segment is ochre-yellow, with four iregular black spots along the hinder edge, while the area around the base of the four tubercles is blackish. All the tubercles are smaller in proportion to the body, but preserve the same proportion to each other as in the beginning of stage II; the body being larger, the tubercles are wider apart.

Each segment behind the first thoracic with two series of three blackish triangular spots, the middle one in front triangular and longer than the lateral ones (as in the early part of the stage). The one corresponding to it on the hinder line (which is half-way between the dorsal tubercles and the hinder edge) is transversely linear; the spots vary in being either separate or connected; they are smallest on the eighth and ninth abdominal segments. All the tubercles are uniformly dark prussian or steel blue. Suranal plate yellow, except the black subtriangular patch giving rise to the tubercles. Along the side below next to the base of the legs is a series of detached greenish yellow spots, the two on the second and third segments centered by a

steel-blue minute tubercle, this being the fourth on each side. Abdominal legs dark, with a yellow spot at the base on the outside.

Stage III: Described May 29. Length 35 mm. The larva is in this stage a very different creature from what it was in the previous stages. It is now gorgeously colored, and a very conspicuous caterpillar. The ground color of the body is pea-green, while the large swollen base of each tubercle is deep reddish orange approaching vermilion, contrasting with the dark steel-blue of the spines surmounting the base.

The head is very small, not one-half as wide as the body, and one-third narrower than the first thoracic segment. The clypeus-posterior is now pale turquoise-blue, and there is a broad red-orange stripe on each side of the clypeus.

The three black spots on each segment are still large and conspicuous, while those on the hinder edge are minute. The center of the suranal plate and of the anal legs is stained deep red-orange, as also the outside of the mid-abdominal legs. The thoracic legs are also painted with two vermilion-red rings.

There is the same proportion between the size of the dorsal tubercles.

The setæ are scarcely as long as the spines themselves.

Stage IV: Length 38–40 mm. Differs but little from the previous stage in armature and coloration. In this stage most of the larvæ have the tubercles entirely black; in a few, however, the dorsal ones on the second and third thoracic, first, second, third, and eighth and ninth abdominal segments are pale blue at the tips; and sometimes those on a less number of segments are tipped with blue. The six tubercles on the prothoracic segments are still well developed. The suranal plate is pale red; the sides of the anal legs deep bright red, as also are the ends of the mid-abdominal legs; the thoracic legs are black ringed with red.

Stage V: Length 65–70 mm. Head and body pea-green. Shape of the body nearly as in *Philosamia*, but the tubercles very much thicker and larger. Those on the third thoracic segment and first abdominal a little larger than the pair on the second thoracic segment. The dorsal abdominal tubercles somewhat unequal in size, those on segments 2–7 about one-half smaller than those on the first abdominal segment, those on segment six being a little smaller than the others. The median tubercle on the eighth abdominal segment nearly three times as thick as that on the sixth segment. All the tubercles bright red on the swollen base; beyond, turquoise-blue; the short spinules black. Suranal plate, the side of the anal legs, and the thoracic legs yellow. Mid-abdominal legs yellow, black at base.

There are two subdorsal rows of black spots, one on each side; a black band on the front of each segment passes down to a point near the spiracles. The larvæ vary in the amount of black on the body, some having more, others less.

The larva differs from stage IV in the part of the tubercles above the red swollen base being much thicker, the spinules shorter, and there are no tubercles on the prothoracic segment, these being in the last stage represented by black dots.

The larva feeds on the wild cherry.

This is an unusually conspicuous larva, and as usual in the group the bright hues and spots may be regarded as warning colors, the insect being protected by what are probably venomous spines.

In its markings (the six dorsal black spots) and armature it closely resembles *Philosamia cynthia;* the tubercles are all large and of nearly equal size and shape as in the second stage of *P. cynthia*. There is no such inequality as is to be observed in the third stage of *C. promethea*, where the second and third thoracic dorsal tubercles and that in the middle of the eighth abdominal segment are three times as large as all the other dorsal abdominal ones.

Judging by the larval characters *Philosamia cynthia* is a more primitive or generalized form than *Callosamia*, since *Philosamia* retains the equality in the size and shape of the tubercles all through its larval life.

C. calleta up to the end of stage III is really nearer to *Philosamia* than the genus to which it is generally referred, and this suggests that phylogenetically *Philosamia* is the older genus, and that from it directly sprang the species of *Callosamia*, *C. calleta* being the oldest species.

Mode of casting its skin.—Before molting the abdominal legs are folded together and the crown or rings of both are contracted.

One was seen in the act of ecdysis; the skin had split open at various places from one end of the body to the other. The thoracic legs become free or are drawn out of the old skin before the head is cast off.

EPIPHORA Wallengren.

[*Epiphora* WALLENGREN, Wien, Ent. Mon., IV (1860), p. 167. Type, *E. mythimnia* (Westw.)=*scribonia* Walleng.]
[*Faidherbia* GUÉRIN, Compt. Rend., lx (1865), p. 162. Type, *E. bauhiniæ* Guér.]

[Kirby lists four species:

(1) *E. mythimnia* (Westw.). South Africa.
(2) *E. perspicua* (Butler). Old Calabar.
(3) *E. atbarina* (Butler). Abyssinia.
(4) *E. bauhiniae* (Guér.). West Africa.

E. rectifascia ROTHSCHILD, 1907 (figured in Nov. Zool., 1908, Pl. IX, fig. 3) is from Stanley Falls.]

EPIPHORA BAUHINIÆ (Guér.).

Plates XLIV, fig. 1; XCIV, figs. *d*, *e*, *f*.

Larva.—Size and general shape of [*Samia*] *cecropia* larva, with blue tubercles ending in vermilion; tubercles rather long and blunt at end, those on abdominal segments 4 to 8 all red. A lateral row of blue spots, a pair on each segment. Head pale, of same color as body; body is represented as whitish. From a poor colored figure in Museum at Paris.

Cocoon.—Oval, with a stalk. A cocoon observed with two larvæ in it.

EPIPHORA MYTHIMNIA (Westwood).

Plate XLIV, fig. 2; LXXXVIII, fig. h; XCIV, fig. g.

PHILOSAMIA Grote.

Samia HÜBNER, Verz. bek. Schmett., p. 156, 1822? [Sherborn and Prout (Annals and Mag. Nat. Hist., 8th series, vol. 9, p. 179) have adopted the date 1820 for this part of the Verzeichniss; but they admit that the precise date is a matter of "pure speculation."]
Philosamia GROTE, Proc. Amer. Phil. Soc., XIV, p. 258, 1874.

[Rothschild, Nov. Zool., II (1895), arranges the species thus:]

1. *P. cynthia* (Drury). [Java.]
2. *P. lunula* (Walker). [East Indies.]
   ab. *obscura* (Butler).
   ab. *guerini* (Moore). [Bengal.]
3. *P. walkeri* (Felder)=*cynthia* auctt (nec Drury). [North China.]
   ab. *iole* (Westw.). [Assam.]
   subsp. *pryeri* (Butler). [Japan.]

[Rothschild has the type of *P. walkeri*. He also has two specimens of *iole* bred from eggs laid by typical *P. walkeri*. Dr. Packard copied out the data from Rothschild, without indicating his opinion of them.]

Imago.— ♂. Antennæ pectinated to the end, those of the ♀ nearly as broad as in ♂. Fore wings more elongated and falcate than usual, much more so than in *Callosamia*. Hind wings much elongated posteriorly, triangular, more so than in *Callosamia*.

The discal spots of the fore wings long and narrow, curved sometimes (*vacuna*), comma-shaped and connecting the very distinct basal and extradiscal bands, and situated more or less parallel with the costal edge of the wings; those of the hind wings are usually boomerang-shaped, being much bent or sharply curved. The middle of the spots are clear, nearly diaphanous, and the posterior side of the clear space is filled in with yellow ocher scales (*cynthia*). These spots are much more specialized than in *Callosamia*.

The subapical ocellus is somewhat reduced, compared with those of *Samia* and *Callosamia*, with a tendency to become flattened oval.

Abdomen banded with white, with a median, lateral-dorsal, lateral and ventral row of tufts of white hair-like scales.

Wing markings: Extradiscal band broadly shaded with white, the white shade very broad in the African *vacuna* and *albida;* not scalloped, nearly straight and only curved outward opposite the end of the discal spot. Edge of both pairs of wings two fine lines, four lines in all; three marginal lines in the hind wings. Fore wings without the very sinuous submarginal line of *Callosamia.*

PHILOSAMIA CYNTHIA (Drury).

Plates I; II; III; XLVIII, figs. 1–4; LVII, figs. 3, 4; LXXVI, figs. 2, 3; LXXXVIII, fig. *b* (*canningi*); XCII; XCIII, figs. *a*, *b*, *c*, *d*.

[*Attacus cynthia* Drury, Ill. Ex. Ent., II (1773), Pl. 6, fig. 2.]
[*Samia cynthia* Jordan, Seitz, Macrolep., Div. 1, p. 212, 1911. Two subspecies recognized—*pryeri* and *walkeri*.]

[The account here given refers principally to *P. walkeri* (Felder), but includes (Javan race) the typical *cynthia.* The American insect belongs to *P. walkeri*.]

Moth.—One ♂. Fore wings slightly more falcate than usual, more so than in *P. lunula* (*ricini*), and a little longer in proportion than in that species. Hind wings with the outer edge straight, less convex or rounded than in *P. lunula,* and the hind angle more pointed, less rounded than in *P. lunula;* the end of the abdomen only reaches to the end of the basal white band of the hind wings, whereas in *P. lunula* it extends considerably beyond it.

Body and wings ochreous, with no olive tints. Patagia edged with white. Fore wings; the space enclosed by the basal white line regularly oblong, nearly as wide at the base of the wings as at the distal end, otherwise the same; the extradiscal line more deeply bent out (as if pushed out by the discal spot) than in *P. lunula;* the white line is edged on the inside with black, on the outside by dull pink, succeeded by a white band. The ring beyond this line is dark ochreous. Margin of the wing ochreous Vandyke brown. Subapical white line scalloped with four rather coarse, more obtuse points than in *P. lunula.* The narrow submarginal line is alike in both species, with a deep regular sinus in cell.

Ocellus flattened oval, distinct, the whitish blue line distinct, and forming a slightly less open semicircle than in *P. lunula.* Hind wings with the extradiscal line, as on the fore wings, deeply bent outwards opposite the distal end of the discal spot; the line otherwise is much the same in both species.

Discal spot of both wings decidedly longer and narrower than in *P. lunula,* and less curved. The clear nearly diaphanous middle portion is more distinct than in *P. lunula* and the yellow ocher hue is more decided. The submarginal spots on the hind wings are dusky, contrasting with the ocher of the wing. Beneath the hues are a little faded. Abdomen yellowish, not whitish as in *P. lunula.*

Expanse of fore wings, 140 mm.
Length of fore wing, 70 mm.; of outer edge, 46; inner edge, 39 mm.
Length of hind wing, 56 mm.; greatest breadth, 35 mm. (of *P. lunula,* length of hind wing, 45; greatest breadth, 30 mm.).
Discal spot of fore wings, 19 by 4; of hind wings, 18 by 3½ mm.

This species (my single ♂ from Canton, China) is pale ochreous; the discal spots are longer, the extradiscal line more bent outward, and the hind wings nearly straight on the outer edge, not convex and rounded as in *P. lunula,* and the European and American adventive races of *P. cynthia.* It occurs in China, north to near Pekin, lat. 35°–40°.

The Java race.—A pair from Malang, east Java, are quite different from the Assam form, as would seem natural when we consider the geographical difference between the two rather distant regions.

One ♂, one ♀. Both individuals present the characteristic diagnostic mark by which, in all the examples I have seen, the species differs from *cynthia.* This is the little angle or forward projection at the end of the discal spot of the fore wing facing the costa, and situated next to the extradiscal line. It also differs decidedly in the greenish ochreous hue, being light

olive green as in the *cynthia* from China. The white lines are narrower; discal spots longer and narrower; the extradiscal line is much farther from the basal white line, not meeting, as in the Assam race. In the ocellus the white line is more open, not so closely curved. The fore wings are more falcate and narrower, but the hind wings of nearly the same shape. In the hind wings the extradiscal line is less regularly incurved and is irregular, sinuous, and farther from the discal spot. It is also much larger.

Expanse of fore wings, ♂ 140 mm.; fore wings, 70 by 30 mm.; hind wings, 52 by 32 mm.

Expanse of fore wings, ♀ 145 mm.; fore wings, 78 by 35 mm.; hind wings, 55 by 38 mm.

[According to Kirby, Rothschild, and others, the Javan insect (*Saturnia insularis* Voll.) is the genuine *cynthia* of Drury. Dr. Dyar remarks (in litt., March, 1912): "Drury's figure is quite unlike ours in having pale rays on the veins of hind wing from the pale band, which never occurs in our *cynthia*. This marking is well marked in a species from Java before me (presumably *insularis* Voll.)." In a later letter he refers to the species from Java as "the real *cynthia*."]

[The following notes, copied by Mrs. Packard from rough memoranda of Dr. Packard appear to be of later date than the above:]

One ♂ *cynthia* from Jaintia Hill, Assam, and one ♂, ♀, from Punjab, India. All differ from Canton, China [example], one ♂ in the hind wing being full and convex on outer edge, *almost as much so as in American race.* All are ochreous and nearly identical in hue with Chinese. The ocellus is rounder and the semicircular white line is slightly less oblique than in the Chinese. The discal spot on hind wing more bent than in Chinese, and extradiscal line on hind wing is near orange.

Assam (male): Length fore wing, 72 by 35; hind wing, 55 by 35; convexity, 9–10. Discal spot fore wing, 19 by 4; hind wing, 9 by 5; ocellus, 4 by 5.

While the Indian examples are much alike, there are indications, which more examples might confirm, that the Jaintia Hill, Assam, differs locally from the Punjab (though it is an introduced and domestic form in Indies, as I understand it), the Assam ♂ compared with Punjab ♂ is larger, discal spots wider, that of hind wing more bent or suddenly curved. In all these respects the Assam is like (except in hue) the American race; i. e., ocellus, shape of discal spots, and fullness of outer edge of hind wing.

♂ Punjab: Fore wing, 64 by 31; hind wing, 48 by 32; fore wing discal spot, 10 by 3; hind wing, 11 by 3.

♀ [fore wing], 68 by 38; hind wing, 52 by 37; forewing discal spot, 14 by 3; hind wing, 12 by 3½; convexity, 10–11 mm.

Philosamia cynthia; new adventive American race.

In 1875, in his "Lepidoptera, Rhopaloceres and Heteroceres, indigenous and exotic," Strecker called attention to this new race or "Darwinian species," stating that "after a several years' acclimitization in the United States a curious change takes place; the fore wings become less falcate (being now not more so than in *ceanothi, angulifera*, etc.), the secondaries much less elongated and all wings increased much in breadth; the discal lines also become shorter and broader, more like those of *cecropia*, and we can now place the insect in *Platysamia*.

"The Chinese examples in my cabinet average 5 inches in expanse, those raised from eggs brought from China the same. The first brood, raised from ova deposited by the latter were all small, averaging only 4 inches, but preserved the typical Asiatic form. Afterwards I let all fly as they emerged, and those that issued from cocoons collected in the woods near Reading, four or five years later (doubtless the descendants of those that I let loose), averaged 5½ inches and were as broad winged and unAsiatic in appearance as *cecropia* and allies" (p. 103).

This adds another case to the list of new climatic races arising in North America from European or Asiatic parent species. It should be said that Dr. Strecker's statements will apply

to the hind wings, but not to the fore wings, as in the ♂ native Chinese and Pennsylvania race he has kindly sent me the fore wings are of the same width in both forms.

Imago.—Two ♂, two ♀. Compared with a Canton, China, ♂ of the normal form (perhaps of the summer ochreous form), the principal and most striking differences are, besides the rich olive green color, the shape of the ocellus, the shorter discal spots of both wings, and the shape of the hind wings. Body and wings of a rich olive green and of about the same size as that of the parent Chinese species. Fore wings slightly narrower than in the normal Chinese *P. cynthia.* Head at base of antennæ and on the sides white. The ocellus is rounder, not so obliquely oval, and the discal spots of both pairs of wings are decidedly shorter than in the normal Chinese species, those of hind wings boomerang-shaped, translucent in center. The hind wings differ decidedly in shape, the outer edge instead of being nearly straight, having become full and convex. Thus, taking the Pennsylvania and New York ♂ ♂, the convexity beyond a line drawn from the hinder end to the apex of the wing is from 7 to 9 mm. in depth, while in the Chinese parent species, ♂, it measures about half as much, i. e., 5 mm.

The sinus in the marginal line of the fore wing situated in the cell next behind the ocellus is shallower than in the Chinese species, the bottom of that of the new American race being eclipsed or filed in by the encroachment of the dark-peppered ochreous shade passing across the wing. The subapical white zigzag line is less marked and the points between the scallops are finer and less distinct than in the native Chinese species. There is no perceptible difference in the markings of the outer margin of the hind wings. The male antennæ (width 5 mm.) and palpi are the same in both forms. The palpi are 3-jointed, large, the "tongue" (maxillæ) is as long as the head is broad. The thorax under the insertion of the wings and the fringe on the legs white.

Abdomen white at base with a broad median broken white line, the segments being entirely white in the middle, the white extending down the sides towards the end of the body; with two series of white tufts on the sides, those of the upper series the larger; also a double row of ventral white small tufts.

On the whole, the new American race is a very different one from the Chinese or oriental parent species, and judging from Grote's photograph the European form varies in almost exactly the same way.

Expanse of fore wings, 131 mm., ♀ 71.

Length of fore wings, ♂ 62 mm.; breadth from inner angle across the middle of the discal spot to the costa, 30–31 mm.; ♀ 38 mm. Chinese form, breadth from inner angle across the middle of the discal spot to the costa, 32 mm.

Length of hind wing, ♂ 43–47 mm.; ♀ 55; breadth, ♀ 38 mm.

Length of discal spot of fore wing, ♂ 14½–16 by 3½–4½ mm.; ♀ 17 by 6 mm.

Length of discal spot of hind wing, ♂ 10–11 by 5–5½ mm.; ♀ 12 by 4½ mm.

Length of ocellus, ♂ 4 by 3 mm.; in ♂ Chinese parent form, 6 by 3½ mm.; in American race, ♀ 5 by 3½.

[A memorandum in pencil, probably of later date, notes:]

[Moths bred from larvæ] fed on castor oil plant (Akhurst) have lower band on hind wing and all the dark markings on fore wing black and increased in width and size. One specimen Mr. E[lliot] reared on butternut was suffused all over with dull yellow. [One raised] on dogwood [had] an extra band in middle of fore wing, forming a discal spot not found in the normal specimens, so as to make a new variety.

[In his account of *P. lunula* below, Dr. Packard gives the name *advena* to the American race. Mr. J. H. Watson has also given it a manuscript name. Dr. Dyar (litt., May 8, 1912) writes with reference to the materials available in the United States National Museum: "Our species is nearest to *pryeri* of anything I have, and is not like the *walkeri* from India." There is nothing in the Museum from China.

J. B. Smith (Proc. U. S. Nat. Mus., IX (1886), pp. 417–418), says: "The species varies from a bright, almost ochre, yellow to a pale greenish-clay color. The violet or lilac is also variably intense and the lines vary somewhat. * * * Since the date of its introduction

into this country (1861) this insect has undergone a considerable change in color and wing form, quite marked when compared with specimens from China. It is larger, deeper in color, and the wings are much broader and more rounded, much less excavated below the apex."]

[*Geographical distribution.*—The records of the United States Department of Agriculture indicate the occurrence of *P. cynthia* auctt. in New York (Long Island); New Jersey (Jersey City and Trenton); Pennsylvania (Philadelphia); District of Columbia (Washington), and Virginia (Richmond).]

[The type of *Philosamia* Grote is now given as *P. walkeri* (Feld.)=*cynthia* (Drury), vol. 2, Plate 6, fig. 2. It is there stated as coming from China; also Cramer quotes Drury and figures the same insect on Pl. XXXIX, fig. A, but the figure there given is slightly different from Drury's which shows the pink fascia in hind wing to run outward along and each side of the veins and giving a serrated outer edge to this fascia. Rothschild in Nov. Zool., vol. 2, 1895, p. 37, holds this form (to which both Drury and Cramer give the habitat as China) to be the true *cynthia* of Java=*insularis* (Voll.), and take *walkeri* (Feld.) to be the true Chinese insect.

If, however, Cramer's and Drury's figures are trustworthy, the shape of the wings there drawn is not *insularis* (Voll.), neither are the colors; *insularis* (Voll.) has the most angular wings of any *Philosamia* and the pink fascia is almost straight across the wings on the inner edge. The color is pale brown and very pale pink (not bordered with black, as Drury and Cramer show) and the wings are very sparsely covered with scales. The outer margin of pink fascia I have in specimens from western China and Hongkong showing this, but not so pronounced as a pair from Hainan given me by Mr. Rothschild, which form more nearly resembles *insularis* than any other of the mainland forms from Asia. Sumatran *insularis* agree with those from Java. Speaking of *cynthia* (Dru.) in the U. S. A., Prof. Smith in his Revision of Saturnidæ, Proc. U. S. National Museum, 1886, p. 417, says: "The moths emerge in the latitude of New York late in June or early in July; in Washington two or three weeks earlier. There are annual broods in these latitudes.

"Since the date of its introduction into this country (1861) this insect has undergone a considerable change in color and wing form, quite marked when compared with specimens from China. It is larger, deeper in color, and the wings are much broader and more rounded, much less excavated below the apex." This rounding is more noticeable in the male than the female, but the color of both sexes has become yellowish green, not darker. The American naturalized form may, however, be separated in all the New York and Philadelphia specimens which I have seen by the glassy area, which is broader, and the inner yellow scaling is also broader. The lunules are more arched. The only wild form approaching the American is *canningi* (Hutt.) from Assam.—J. H. Watson.]

Life history.

The eggs were received from Mr. H. Meeske. The larvæ were at first fed on the leaves of the ailanthus, but when transferred to Brunswick, Me., ate freely of the wild plum.

The egg.—Regularly oval-cylindrical, dull chalky white; the surface of the shell finely pitted, but not arranged in wavy rows as in *P. cecropia;* the pits under a half-inch objective are near together and slightly polygonal, and their walls project as little bosses on the inside of the shell. Length, 2 mm., thickness, 1.4 mm.

Larva.—Stage I: Hatched June 11. Described one day after hatching. Length 4–5 mm. Head rather large, as wide as the prothoracic segment. The body gradually tapers from the head to the tail, and is of a pale greenish yellow, the head dark chestnut, with a pale greenish clypeus and labrum. The prothoracic segment is broad and somewhat flattened above, with a dark chestnut-colored chitinous plate or squarish patch on each side, sometimes appearing as widely separated by a pale greenish yellow clear median dorsal space; with four dorsal and two lateral black tubercles; of the dorsal ones the two in the middle are slightly larger than those outside, and larger than the lateral ones; they are also connected at their base by a slight ridge. All the tubercles are much alike on all the segments, bearing from five to seven setæ, those on abdominal segments five to seven scarcely smaller than those on the thoracic. The hairs or bristles are whitish, or rather colorless, four or five to seven on each dorsal tubercle;

they are slender, not stiff or thickened at base, and are spinulated, the spinules short and acute; under a half-inch objective they appear, not bulbous, but tapering, and being transparent may be glandular.

The single median tubercle on the eighth abdominal segment is sometimes nearly twice as large as the others on the same segment, and is double, being broader than long, bearing four bristles on each side.

There are two setiferous tubercles on the ninth abdominal segment, and, as generally in the group, two short but large ones on the tenth, being situated on the front edge of the suranal plate, and bearing each eight bristles. All the tubercles on the body are jet-black.

The spiracles are pale and inconspicuous. The thoracic feet bear three lancet-shaped tenant hairs, but they are a little wider than those of *S. cecropia*. The abdominal feet bear 14 crotchets.

Before the first molt the larvæ increase in size and length (7–8 mm.), becoming much fuller, swollen out with food; the body, however, is smooth, the segments not being swollen; it is bright straw-yellow; the spines are not so long as before, and the bristles are considerably shorter. *A dorsal row of dark spots is present.*

Before a change of skin the larva rests immovably for several hours, the membrane in front of the prothoracic segment being swollen between the head and the front edge of the segment, and the head, now appearing to be very small in proportion to the swollen prothoracic segment, is held downward, while the thoracic feet are stretched forward. In molting it leaves behind it only a small mass of crumpled skin, as the cuticle is so thin.

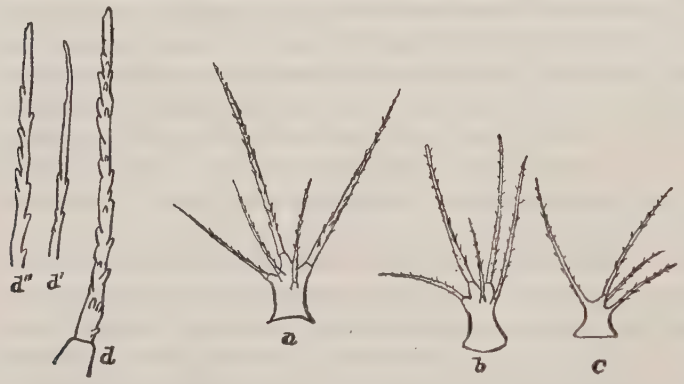


Fig. 30.

Figure 30, *a*, dorsal tubercle on second thoracic segment; *b*, the same on the third thoracic segment; *c*, a subdorsal tubercle of the seventh abdominal segment; *d*, a seta; *d'*, *d''*, ends of two others. All stage I. Drawn with the camera.

Stage II: One had just molted, June 17. The body was all yellow except the dorsal and two lateral rows of black spots between the rows of tubercles, there being two spots in each row on each segment. All the tubercles are now amber-yellow, and the hairs are pale.

An individual was noticed to increase in length soon after ecdysis. It was observed at 4.20 p. m. In about 20 minutes or half an hour after molting, when it is 9 to 10 mm. long, the tubercles on the side, especially those in front, begin to turn dark, the thoracic ones first changing color. In about an hour an obscure broad dusky band crossing the head appears; in 50 minutes or an hour, the thoracic legs have turned blackish, and by this time the creature begins to eat, this species feeding well in confinement. In an hour and a half the lower lateral (infraspiracular) row of tubercles and those on the tenth abdominal segment had turned black, but the upper lateral and dorsal ones were still pale. By 6.30 p. m. the others, both dorsal and lateral, had become dark at the tips, but the hairs were still pale. About a day later, i. e., at 5 p. m., the tips of the tubercles only were dark, the bases being still pale yellow as before.

This stage differs but little from the first, chiefly in the *pale honey-yellowish head;* there are as yet no differences in the size of the dorsal tubercles, though they are in this stage *pale yellowish at the base,* where before they were black throughout.

Stage III: They molted again, June 22–23. Length, 14–15 mm. The body is of the same yellow hue as before, the tubercles at first being all yellow. The lateral ones are the first to turn dark. The head is pale yellow, concolorous with the body.

In the preceding stage, on each abdominal segment there is an upright faint short blackish stripe behind the spiracle; in the present stage there is a jet-black stripe, which is somewhat curved or excavated on the front edge; there is none on the prothoracic segment, and the stripe is represented on the second and third thoracic segments by an irregular black rounded dot.

At the base of the thoracic legs is a black dot, not present at the base of the abdominal legs. The tubercles are nearly of the same shape and relative size as in stage II, *but the six dorsal and four last abdominal (the dorsal ones on ninth and tenth segments) are slightly larger than the other abdominal ones,* while the spiracles are larger than before and black; the other black marks are as before.

Stage IV: One molted again the morning of July 1. Length 15–16 mm., one 20 mm. and eventually becoming 25 mm. When observed an hour or two after casting its skin, the body as before was pale lemon-yellow; the tubercles of the same color as before, i. e., pale greenish yellow, except those of the lower lateral row, which are black on the trunk, but with the head or end and the spines light greenish yellow. The dorsal and two lateral rows of black spots are as before. The head and upper side of the prothoracic segments are shining honey-yellow, *as is also the ninth and tenth abdominal segments, while the body is covered with a whitish mealy bloom.*

The larvæ, which were reared in Brunswick, Me., from eggs laid in Brooklyn, seem to feed sparingly and to grow slowly, and were fed at first with ailanthus, and afterwards with wild plum. They became before molting again very white, *the bloom being thick and powdery, so that the honey-yellow head and prothoracic plate, with the suranal plate, together with the sides of the anal legs and upper part of the ninth abdominal segment, contrast with the color of the body.*

In this stage the two anterior setiferous tubercles on the suranal plate are still well developed, as are also their bristles.

Stage V.—Molted July 15–18. Length 40 mm. It differs from the preceding stage in the rarely beautiful *pale turquoise-blue edging on the edge of the suranal plate and anal legs, and in the pale bluish tint on the ends of all the tubercles, and at the base of the middle abdominal legs.*

The head is lemon-yellow as before, about one-half as thick as the body, and is bluish on the region of the eyes. The prothoracic segment is lemon-yellow, edged with pale blue, while the tubercles are of a beautiful pale turquoise tint. The tubercles are still long and slender, those of the thoracic and last two segments scarcely larger than the others.

In this genus the tubercles are remarkably long, with short, small, pale radiating bristles, much shorter and slighter than in *Samia.*

The suranal plate also in stage V *bears two low bosses without bristles* (only their rudiments), while in *S. cecropia* these tubercles with their bristles are well developed; it also differs in the black spots of the last stage.

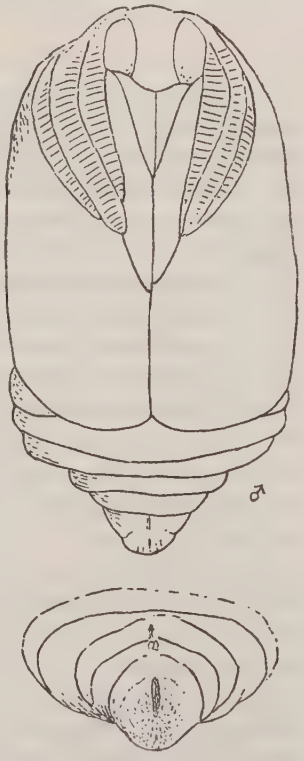


FIG. 31.—*Philosamia cynthia* [*walkeri*] male pupa.

Those of the dorsal and subdorsal rows are pale whitish green at base, passing toward the end into pale turquoise-blue. The infraspiracular row of tubercles are ringed with black at the base. The black spots on the body are as in the previous stages. The thoracic and abdominal legs are lemon-yellow, the latter pale bluish at base and on the planta. The suranal plate and dorsal region of the ninth segment are lemon-yellow, the thickened much swollen edge of the suranal plate is turquoise-blue, including the tubercles, and the edge of the anal legs is of the same tint, the blue suddenly expanding on the lower side above the crotchets.

In this stage the body in general is turquoise bluish white, rather than pure white or slightly yellowish white, as in stage III.

August 20 one spun a cocoon, and the others stopped growing, perhaps partly on account of the cooler climate than their parents had experienced, though the season of 1890 was a warm one for Maine.

By the larval characters this Chinese or eastern Asiatic genus is much more closely allied to *Samia* than to *Attacus,* though the imago perhaps has more of the habit and general form

and appearance of *Attacus*. It differs from *Samia* in the rather slender body, the decidedly longer tubercles, and the slighter, shorter bristles arising from them, and in coloration by the pale lemon-yellow skin, with the conspicuous black spots, and the beautiful turquoise-blue markings, as well as the peculiar soft white bloom on the skin. How far this style of ornamentation adapts it to its native Asiatic food plant we do not know.

Recapitulation of the more Salient Ontogenetic Features.

A. Congenital Features.

1. Hatched with large, well-developed setiferous tubercles; but the bristles not bulbous in stage I.

2. The body pale, but the tubercles dark, and besides these intertubercular conspicuous black spots are present in stages I to V.

3. The homologue of the "caudal horn" is double, bearing four bristles on each side.

The difference between the larva of the first stage and the last, unusually slight compared with *Samia* and *Callosamia*.

B. Evolution of later Adaptational Features.

1. The tubercles become pale at tip in stage III, and those of the two dorsal rows of the thoracic and last two abdominal segments become slightly larger than those of abdominal segments 1 to 7, in stage III.

2. Differences in coloration appear in stage IV, the head, prothoracic and last two abdominal segments being honey-yellow, thus contrasting with the whitish body, with its whitish bloom, which also appears in this stage.

3. Further changes in color appear in the last stage, the ends of all the tubercles becoming pale bluish, and the edges of the suranal plate and anal legs being a rich turquoise-blue.

4. In the last stage a very slight difference in the size and shape of the thoracic and the last abdominal tubercle.

5. The tubercles on the suranal plate become reduced to low bosses, without bristles. Thus *Philosamia cynthia* is a decided step in advance of *Samia*, and appears to be a later formed genus.

Comparison between the larva of Philosamia and Callosamia.—The fully fed larva of *Philosamia cynthia* is in the shape of the head and body, and in the shape of the tubercles with which the latter is armed, more allied to *Callosamia* than to *Attacus*, although the imago is perhaps as near the latter genus as to *Callosamia*. The head of the larva of *Philosamia* is almost identical with that of *Callosamia*. The nearly obsolescent tubercles on the prothoracic segment have about the same degree of degeneration in *Philosamia* as in *Callosamia*, but the former differs in the fact that the lateral tubercles in all three thoracic segments are well developed, and end in a head armed with four spines, as in *Samia* (*S. cecropia*), while the tubercles are as well developed on the abdominal segments as on the thoracic. The thoracic tubercles also are no more differentiated than the abdominal ones. *Philosamia* also differs from *Callosamia* in the 12 rows of black spots along the body. The larva of *Philosamia* is thus seen to be intermediate between *Samia* and *Callosamia*, but the moth is apparently intermediate between *Callosamia* (*C. angulifera*) and *Attacus*.

The head and the shape and size of the body of the larva are like those of *Callosamia*, but in its secondary adaptive generic characters it retains a resemblance to *Samia*. In a systematic classification, then, we had better adopt the imaginal characters rather than the larval, the latter being so much more plastic and more readily influenced by changes in the mode of life and by differences in the food. In its earliest larval stages, the insect is certainly more like *Samia cecropia* than *Callosamia*, but still even in these stages *Philosamia* is more advanced than *Samia*, which in its earliest larval stages, especially in the possession of long bristles arising from the short tubercles, intergrades with or is closely allied to the fully grown larva of *Saturnia carpini;* and in the imaginal characters *Samia* is nearer the ancestral form *Saturnia* (in the restricted sense) than to any of the other Attaci. If we do as we should do in locating *Philosamia* in its proper taxonomic position, we shall not err greatly in placing *Philosamia* much above *cecropia*, and on the whole near *Attacus*.

[The following notes were made by Mr. T. Pergande at the United States Department of Agriculture; they appear to indicate that the species is not altogether adapted to American conditions, and that while it will feed on other plants than *Ailanthus*, it does so at a great disadvantage. Received (Apr. 14, 1881) from S. Lowell Elliott, New York, 220 cocoons of *P. cynthia* with the following notes: "One hundred *cynthia* from *Ailanthus*, collected last fall and wintered in the house; 100 *cynthia* from *Ailanthus*, collected this spring, selected from nearly 700 cocoons; the balance were dead, killed by the late warm weather last fall and the succeeding cold winter. You will not obtain imagos from all of these, the past six months have been very severe on all insect pupæ; 20 *cynthia* from other trees and shrubs; you will find them much smaller than those that fed on the *Ailanthus*. Nearly all the trees and shrubs in the Central Park had the larvæ of *cynthia* feeding on them last summer, but the caterpillars, excepting those from the *Ailanthus*, were of small size; great numbers died before forming their cocoon, and nearly all the cocoons gathered contained dried caterpillars. I found Ichneumons for the first time in the *cynthia* cocoons gathered during the winter of 1879–80. In those collected in the winter of 1880–81 I found Ichneumons had increased in number, and that *cynthia* had been attacked by a new enemy, a Dipterous insect."

From the cocoons received, as above, Mr. Pergande bred in May many specimens of the Chalcidid parasite *Spilochalcis mariæ* (Riley). His notes are as follows: "From cocoons of the above moth received from S. Lowell Elliott, New York, issued May 12, 107 specimens of *S. mariæ;* of these 26 were males and 81 females, all vary greatly in size; the smallest female is scarcely one-fourth the size of the largest, and the smallest males is about one-third the size of the largest male, and the largest female is about twice the size of the largest male. On May 13, 3 ♂ and 22 ♀ issued, and on May 19, 7 ♂ and 9 ♀." [1]

Notes by Dr. C. V. Riley, preserved at the Department of Agriculture, describe the transformations of *P. cynthia* Auctt. Eggs received from New York hatched July 15, 1869. On July 20 Riley notes: "They seem to feed with equal relish on plum leaves as on those of the *Ailanthus;*" but on July 30 he has to note: "A great number of them have died, absolutely rotting on the leaves, and I only have about 12 left; of these most of them have only cast their second skin, while two of them have cast their third."

Dr. Riley has a note from J. S. Ridings, dated 1869, to the effect that the moths are becoming darker in Philadelphia.]

PHILOSAMIA PRYERI (Butler).

Plate LXXVII, fig. 1.

Attacus pryeri Butler, Proc. Zool. Soc. London, p. 387, No. 18, 1878. Illustrations of Lep. Het. Brit. Mus., Pl. III, p. 11, Pl. XLIII, fig. 5, 1879.

"Allied to *A. walkeri* of Felder from north China, but darker than any of the species of the *A. cynthia* group; olive-brown, with paler borders and the usual submarginal lines; the pale belt (bounding the dark angulated central line externally) white inwardly, pinky whitish and diffused outwardly, with no defined intersecting stripe as in all the allied species; the maggot-like markings, basal white belts, and the apical markings of primaries as in *A. walkeri*. Expanse of wings, ♂ 5 inches, 10 lines; ♀ 6 inches, 2 lines. Yokohama (Jonas)."

[Rothschild makes it a subspecies of *P. walkeri*,]

This is evidently only a climatic variety of *P. cynthia;* it differs, according to Butler's figure, from my ♂ *cynthia* from Punjab, India, only in being darker, and in the basal line on the fore wings being bent out just behind the costa, and more curved between the discal mark and the base of the wing. The discal marks, extradiscal lines, and other markings are the same, though the apical ocellus is not so large and distinct, and more narrowly oval, it is of the same size.

Life history.

Eggs from Yokohama, Japan. [Larva] full fed October 11, in New York [raised by Joutel].

Length 50 mm., width of head 5 mm. Indistinguishable from *cynthia* raised in New York, so much alike Joutel saw no use in drawing it.

[1] [As to *Spilochalcis mariæ*, see also Entom. Mo. Mag., Aug. 1893, p. 194.]

Body pale delicate pea-green, with a fine whitish bloom or powdery effect. Head yellowish green, turquoise on the labrum and base of antennæ. All the dorsal tubercles delicate turquoise, base faintly yellowish-green. Those of infraspiracular row and the lowest thoracic row deep black at base, the dorsal tubercles all alike, both thoracic and abdominal; those on ninth abdominal segment a little shorter. One or two of the longer of the three to four terminal [spinules] are slightly longer than the tubercle is thick. Usually two of the four terminal [spinules] are short and sharp, the two others longer and more hair-like.

The four dorsal prothoracic tubercles are flattened, transversely oval, polished bosses, the inner two giving rise to two setæ and the outer two to four to six setæ, all black. Prothoracic shield straw-yellow and segments 9–10 and central part of anal legs straw-yellow with a greenish tinge.

Horn on eighth abdominal segment a third thicker than the other abdominal tubercles, the tip distinctly bifid, though the sinus is shallow, with four [spinules] on each side.

All the four dorsal tubercles on each segment, thoracic and abdominal, arise from a transverse distinct ridge. On prothoracic plate a minute black spot on each side; two median black dots on [mesothoracic segment] one behind the other, one only on metathoracic segment, none on first abdominal segment, but on [each of] segments 2–9 is one, each situated on median line, just behind the ridge, those on hinder segments largest. Between the dorsal and subdorsal rows of tubercles are two black dots and three black dots (one triangular) near the black spiracles, one in front of and two behind the spiracles; sometimes (segments 4 and 5) the two nearest the spiracles are wanting. A black dot at base of thoracic and two at base of each abdominal legs. Thoracic legs yellowish, abdominal legs of four middle pairs turquoise at base. Most of legs honey-yellow and planta pale soft greenish turquoise.

Anal legs honey-yellow in middle, but lower and inner edge turquoise.

Suranal plate regularly triangular, the surface smooth, with no minute papillæ and hairs, but near the end are two broad flattened low turquoise tubercles, each bearing about eight minute papillæ; between and behind there are minute papillæ with black fine setæ.

On prothoracic segment lowest small tubercle is all black, and those of the lowest lateral row are black at base like those of infraspiracular row. Only differs from B[ridgham] drawings in there being but a single dorsal instead of two black dots on median line of each segment, and hairs are *all* black in *pryeri*. (are they white as B[ridgham] represents in normal *cynthia*?) and B[ridgham]'s abdominal legs are *all* yellow, no turquoise at base or on planta.

Pryeri cocoons.—One like *cynthia* in a leaflet of *Ailanthus*, with a well-developed stem, but the outside of the cocoon is all salmon-red and surface more corrugated. Joutel says the color changes to that of *cynthia* after it emerges.

PHILOSAMIA IOLE (Westwood).

Type, from Assam, in Oxford Museum. Wings remarkably narrow; hind wings half as wide as usual; discal spots nearly effaced by a broad diffuse whitish band; no basal crossband.

PHILOSAMIA LUNULA (Walker).

Plate XLVIII, fig. 5; LXXVII, fig. 2; LXXXVIII, fig. *a;* XCIII; figs. *e, f, g, h, i.*

Attacus lunula Walker, Cat. Lep. Het., V, p. 1221, No. 18, 1855.
Philosamia lunula Butler, Illustrations of Lep. Het. Brit. Mus., V, p. 60, Pl. XCIV, fig. 1, 1881.
[*Attacus ricini* Hutt., J. Agric. Hort. Soc. Ind., XIII, p. 71 (1863); cf. W. F. Kirby, Cat. Lep. Het., 1, p. 748.]
[*Saturnia arrindi* Royle, Rep. Paris Exhib., III, p. 216 (1856); cf. W. F. Kirby, l. c.]

[According to Rothschild, *P. guerini* (Moore, 1859) from Bengal and *P. obscura* (Butler, 1879) from Cachar are "aberrations" of *P. lunula;* cf. Nov. Zool., II (1895). Jordan (1911) has described *P. lunula fulva*, placing it in *Samia.*]

Imago.—One ♂ from Assam. Antennæ with shorter pectinations than in *P. cynthia* (American race), being 4½ mm. in width. Palpi much shorter than in *cynthia*, not visible, as the front of the head is so hairy, they can only be seen by pushing away the hairs, while the tongue of the American race of *P. cynthia* is visible; it is not to be seen in my single example of

ricini. Fore wings decidedly falcate; hind wings much produced posteriorly and more pointed than in *P. vacuna*, and not very wide or rounded. The ground or general color is in rather peculiar, being a quite uniform dark vandyke brown, much darker than in *P. cynthia* raised in the United States. Fore wings with the basal line white, passing straight from the costa to the inner end of the discal spot, edged externally with dark brown (not so black as in *P. cynthia advena*); a deep scallop in cell IV_1, IV_2 (second cubital), with the sides produced along the base of veins IV_1, IV_2, the remainder of the line joining the extradiscal, thence passing to the inner edge near the base of the wing. Extradiscal line white, not edged with blackish on the inner edge (as in *P. cynthia advena*, United States), but accompanied externally by two bands, the inner of the two (or middle one of the three) vandyke brown, with no lilac shade such as is to be seen in *P. cynthia;* the other line white, both varying in width. Between this and near the margin is a dark vandyke-brown shade, which has a regular edge, except near the apex, where it sends a large tooth-like projection or acute scallop toward and nearly touching the ocellus; there is also a smaller indistinct tooth between this and the costal region, the sinus thus formed being occupied by a white slash extending to the ocellus. Apical scalloped white line consisting of three small teeth, the first one obtuse, that nearest the ocellus sharp.

Ocellus not rounded, but oblique, the blue-white line strong, curved unequally oblique, tne lower side the shorter of the two and narrower and pointed at the end, while the upper arm of the semicircle, or *u*, is docked, the sinus being filled in with pale vandyke brown, and the black outer shade in a narrower stripe passing around behind the end of the *u*. Submarginal line straight with only a single scallop in the IV–VI cell. Discal spot parallel with the costa, not much curved (shorter than in the adventive United States form), and of the same width as the brown band; quite opaque, scarcely translucent, the white hair-like scales being dense; the hinder ochreous margin of the spot is a little wider than the white portion (the yellow scales on the right side cross to the anterior side of the white band, on the outer side not reaching it).

Hind wings as in the fore wings; three parallel lines forming the extradiscal band, the inner snow-white band being wider than that of the fore wings. The extradiscal band near the costa is continuous with the basal curved white band. Discal spot regularly curved, the outer end not pointed, but encroaching on the extradiscal, which is curved slightly outward, and farther along bends regularly inward. The three darker marginal lines are much alike, the spots forming the inner being nearly continuous. Body whitish at the base and at the tip of the abdomen. Collar white. Legs ochreous and white. Under side of the wings slightly paler than above; the markings a little paler, with a washed-out or faded appearance, especially the ocellus and adjacent marks; no basal band on either pair of wings. Discal spot on hind wings quite regularly bent at each end, not obliquely and unevenly as in the adventive form.

Expanse of fore wings, 120 mm.; length of fore wing, 60 mm.

Discal spot on the fore wing, 12 by 2½ mm.; on hind wing, 6 by 3⅔ mm.

The hind wings are not so much rounded at the end as in *P. vacuna*, being decidedly pointed in the ♂. It also differs from *P. vacuna* in the ocellus being oblique, not regularly oval, and with much less black.

Butler's ♂ from Silhet differs, judging from his figure, from the above-described ♂ from Assam in being smaller (expanding 4 inches 4 lines) and in all the white lines being heavier and broader, though not differing in their contours and relations to each other. The apical ocelli are also a little rounder, less oblique and oval. His example is also drawn as somewhat paler.

[DREPANOPTERA Rothschild.]

PHILOSAMIA VACUNA Westwood.

Plate XCIV, figs. *a*, *b*, *c*.

[*Saturnia vacuna* Westwood, Proc. Zool. Soc. Lond., 1849, p. 39, Pl. 7, fig. 1.]
[*Drepanoptera vacuna* Rothschild, Nov. Zool., II (1895), p. 37.]

Drepanoptera "differs from *Philosamia* by the male having the fore wings much more falcate, elongated and narrower, and the females having all four wings much rounder and blunter.

This new genus differs also from *Philosamia* in having the sexes unlike each other, while in the latter they are identical [The species are]

"1. *D. albida* (Druce).
"2. *D. antinorii* (Oberth.).
"3. *D. vacuna* (Westw.).
"ab. *ploetzi* (Plötz).
"ab. *getula* (Maas. and Weym.)."

[*Drepanoptera* is African, *Philosamia* Asiatic. Dr. Packard had copied the above from Rothschild without indicating any opinion as to the validity of the genus. The manuscript in which *vacuna* and *albida* appear under *Philosamia* is therefore unaltered. On a small slip of paper Dr. Packard has some notes on *P. ploetzi*, *getula*, and *vacuna*, and adds: "*Philosamia*, plainly enough, arose in Guinea or west Africa and spread into eastern Asia. This is near the stem form."]

Imago.—One ♂. Much larger than *P. cynthia;* apex of the fore wing produced, square; basal and extradiscal lines white, very broad and diffuse compared with *P. cynthia* or *ricini.* Discal spot more incurved at the ends than those of hind wings, much broader and shorter in proportion and much curved, like a comma mark. The central portion of the discal spots of both wings is translucent, almost diaphanous. Ocellus oval, black area much larger, and regularly oval ellipical, the whitish blue semicirclar line long, with parallel sides. Marginal line scalloped along the entire length of the wing, and the spots on the margin of the hind wings are smaller and more numerous than in *P. cynthia.*

The general color of the body and wings is vandyke brown, much as in *P. ricini*, but there is more white in this species than the others and there is much white on the under side of the wings. The hind wings are much in shape like *P. cynthia* (American adventive form).

The palpi are short and almost indistinguishable from the hairs of the front of the head. Abdomen white at the base, but with no white above, only on the side is a double white line, and a double ventral interrupted white line, the white being mixed with ochreous hairs. There is a ventral white stripe on each side of the thorax.

Expanse of fore wings, 170 mm.

My specimen is from Benito, French Kongo, west Africa.

It differs from the two Asiatic species *P. ricini* and *cynthia* in the discal spots being large, somewhat commalike in shape, and with the central portion nearly transparent, while the subapical ocellus is complete, the black area large and oval-elliptical. I have examined Westwood's type of this species in the Oxford Museum, and though I did not directly compare my specimen with the type, a brief description agreed with Westwood's example.

P. ploetzi and *P. getula* have the same general style of markings as *cynthia*, the convexity of ocelli being turned toward costal edge; apical ocellus well developed; abdomen banded; very large species.

PHILOSAMIA ALBIDA (Druce).

Attacus albidus Druce, Proc. Zool. Soc. London, 1886, p. 409, Pl. XXXVII.
Philosamia albida Kirby, Syn. Cat. Lep. Het., i, p. 749, 1892.

This form from the Cameroon Mountains, is in size and general appearance allied to *P. vacuna* from the coast of the French Kongo, at a point 150 to 200 miles south of Cameroon Mountains. It occurs also at Ashanti, about 800 miles northwest from Kongo, Cameroon lying between these two localities. It is so similar in its markings to *vacuna* that it seems possible that it is only a local albinic variety of that species.

It differs, judging from Mr. Druce's colored figure, in the white bands and spots being wider, more diffuse, while the discal ocelli of the hind wings are considerably wider, rounder. In other respects it is as in *vacuna*, the ocelli near the apex of the fore wing, the submarginal scalloped lines, and the dull madder markings of both wings being the same; though the extradiscal band of the fore wings is more oblique, ending on the costa at a point about halfway between the outer end of the discal lunule and the ocellus.

I append the description of Mr. Druce.

"♂. The primaries very similar to *A. ploetzi*, but the white band is closer to the outer margin, four round white spots between the apex and the anal angle. Secondaries pure white excepting the outer margin, which is narrowly bordered with reddish brown, with black and fawn-colored lunular markings as in *A. ploetzi;* the vitreous spot long, narrowly edged with black, bordered on the inner side with yellow. The underside the same as above. Head and thorax reddish brown, a wide white band at the base of the thorax, the abdomen brown, banded with white; antennæ and legs pale yellowish brown. The female the same as the male, but slightly more reddish in color, and with all the vitreous spots considerably larger.

"Expanse, ♂ 7 inches; ♀ 6½ inches.

"Hab. west Africa, Cameroon Mountains, Mus. Druce.

"This very fine species comes into the group containing *A. vacuna* Westw., *A. ploetzi* Weymer, from both of which it is at once distinguished by the pure white secondaries."

ROTHSCHILDIA Grote.

Rothschildia Grote, Beitrag zur classification der Schmetterlinge, 1896.

[The following discussion first appeared in Psyche, March, 1902, pp. 322–323:]

This name was proposed by Mr. Grote for the American, chiefly neogaeic, species heretofore referred to *Attacus*. The latter genus, comprising *Attacus atlas*, *A. crameri* and *A. edwardsii*, is restricted to southeastern Asia and the East Indian Archipelago or the oriental region. In fact it is much more closely related to *Philosamia* than to *Rothschildia*. From a study of the venation and other features of six species of *Rothschildia*, it becomes quite evident that the New World or neogaeic species form a group readily separated from the species of *Attacus* of the oriental region, both by the larval and imaginal characters, though in the general appearance of the moths, the shape of the wings and markings, there is a close resemblance.

Fig. 32.—Larva of *Rothschildia* sp. from Arizona. (Wheeler expedition.)

Rothschildia differs from *Attacus* in the following characters: The antennæ have pectinations nearly one-half shorter, and the end of the antenna is subfiliform; the palpi are 3-jointed, those of *Attacus* 1-jointed; the fore tibial epiphysis is in *Rothschildia* narrow, very sharp at the end, about half as wide as in *Attacus*, in which (*A. atlas*) it is oval, and the end obtuse.

The fore wings are less falcate than in *Attacus*, and the hind wings more rounded at the inner angle, not so triangular in outline as in *Attacus*, nor so much produced posteriorly; indeed they are closely like those of *Philosamia*.

In the venation the difference between the Asiatic and American forms is striking; in all the Rothschildiæ examined there is no first subcostal vein (or vein II). In *Attacus atlas*, *crameri*, and *edwardsii* the first branch of the subcostal vein is fully developed, arising at a point near the middle of the discal cell, i. e., within the origin of the common stalk of the other subcostal branches. In this respect it is closely allied to *Philosamia*, where vein II is present. Vein II_2 is minute, very short; II_3 present, normal. In *Rothschildia* vein II is wanting, II_2 is a little longer than in *Attacus* and the other veins of the wings are as in *Attacus*. The venation of the hind wings is nearly the same in both genera. The wonderful similarity of markings, especially the large, clear discal spots in genera quite remote is an interesting case of convergence.

The larva of *Rothschildia* approaches *Samia* rather than *Attacus*. That of *A. atlas* has been well described and carefully figured in all stages by M. Poujade. (Annales Soc. Ent. France, X, 1880, p. 183, Pl. 8.)

The larva of *Attacus atlas* in its final stage is provided with long finger-shaped tubercles; those, however, on the tergum of the second and third thoracic segments are very different in shape, being large, short and rounded, those on the abdominal segments long and slender. Reduction occurs on the thoracic segments only; the two rows of tubercles on the sides of the thoracic segments are of the same shape, but a little longer than those on the abdominal segments.

In *Rothschildia*, as shown by blown examples of *Rothschildia orizaba* received from Mexico, the tubercles are more rudimentary; they are low, short, fleshy, and are crowned with 5–7 small sharp spinules, while those of *Attacus atlas* are long, finger-shaped and unarmed with any spinules. The median tubercle on the eighth abdominal segment is very small, inconspicuous, and but slightly larger than the other dorsal tubercles of the abdominal segments. The dorsal tubercles on the meso- and metathoracic segments are scarcely larger, if any, than those in the abdominal segments.

Burmeister has figured the larvæ of *Rothschildia hesperus, ethra, aurota, betis,* and *speculifer*. In all except *R. betis* they agree well with the larvæ of *R. orizaba;* the thoracic dorsal tubercles being no larger than the abdominal ones, this species approaching nearest to *R. aurota*. In *R. betis*, however, no traces of tubercles are given, and in the text it is stated that the larvæ has no spines; the larvæ is blackish, banded transversely with deep pink-red. The larvæ, then, of the American species hitherto referred to *Attacus* appear to present excellent distinctive characters.

Judging by the larvæ, whose tubercles are more like those of *Samia, Rothschildia* is the more primitive type, and *Attacus* the more specialized. *Attacus* is in venation and the shape of the wings closely allied to *Philosamia* (*P. cynthia*); its larva is more specialized than that of *Philosamia;* but the latter has begun to be specialized in the reduction of the dorsal tubercles of the prothoracic segment, which are short, rounded, and unarmed.

Attacus is confined to the oriental region, while the older more primitive genus *Philosamia* is represented in equatorial Africa as well as the East Indies; it is probable that the Ethiopian realm was the original home of these two genera, unless *Attacus* separated after migration into the East Indies, India, and the East Indian Archipelago.

ROTHSCHILDIA ORIZABA (Westwood).

Plate IV, figs. 1–3; VI; XLV, fig. 5; LXIV, fig. 2.

Attacus orizaba WESTWOOD [Proc. Zool. Soc. Lond., 1853, p. 158, Pl. 32, fig. 2].

Imago.—Four ♂, five ♀. Of the usual fawn-brown. Thorax with a white band. In the male the fore wings more falcate than in ♂ *R. hesperus*. The clear discal spot is triangular, narrower on the fore than on the hind wings, but much alike on both wings, the outer apex of the spot rounded, and either piercing the outer white line (extradiscal) or not quite extending to it; the base of the discal spot either slightly concave or wavy. The extradiscal line is straight, much more so than usual, more so than in *R. jacobææ* or *hesperus*, being either straight or slightly waved or undulating from the apex [of] the clear discal area to the costa, or (one ♀) straight, not waved; behind, from this point to the inner edge of the wing, the line consists of two large scallops, one in the first and one in the second median cell. The white line or band is edged with yellowish brown; beyond is a broad diffuse lilac band, then becoming fawn color, this shade bounded by the submarginal line which is scalloped from the apex to the first median vein, and thence to the inner angle of the wing it is straight. The black spot in the second apical cell is large and distinct, roundish; beyond is a brown figure *8* in one ♀ (fresh and well preserved); each part of the *8* is centered by a conspicuous dark brown spot, the two spots being connected. No dark spot between this and the costa (as there is in *R. jacobææ*).

Hind wings rather prolonged; the clear discal space distinctly triangular, not oval as in *R. jacobeæ* and *hesperus*. The outer line consisting of six rounded, not angular scallops. The spots on the marginal line are large and distinct.

Expanse of fore wings, ♂ 132 mm.; ♀ 125–150 mm.

Length of fore wing, ♂ 68 mm.; ♀ 65–70 mm.

One of my ♀s was compared with specimens so named in the British Museum.

This is the commonest Mexican species. It differs from *R. hesperus* and *jacobeæ* in the outer line of the fore wings being nearly straight and in the discal area being regularly triangular, not rounded. In *R. hesperus* there are no subapical black spots at all. In *R. jacobeæ* the subapical spot is triangular, and forms one of a series of several besides an apical black spot. In both

R. hesperus and *jacobeæ* the outer line of the hind wings is formed of angular scallops. Two ♀s differ in the triangular clear area, in one not reaching the outer line, and in the other the apex cuts through the band.

Geographical distribution.—The Neogaeic realm. In Central America it ranges from Vera Cruz (Franck) and City of Mexico, Tacubaya (Barrett) southward. It will be interesting to ascertain its extreme northern limits on both coasts of Mexico as well as in the interior.

[Rothschild, in *Novitates Zoologicæ*, XIV (November, 1907), has described a number of subspecies of *R. orizaba* as follows:

Rothschildia orizaba peruviana. ♂. Peru.
Rothschildia orizaba equatorialis. ♂, ♀. Western Ecuador.
Rothschildia orizaba cauca. ♂. Cauca Valley, Colombia.
Rothschildia orizaba bogotana. ♂. Santa Fé de Bogota.
Rothschildia orizaba meridana. ♂, ♀. Merida, Venezuela.
Rothschildia orizaba triloba. ♂. Tuis and Carre Blanco, Costa Rica.

Transparent spot on both wings deeply incurved on proximal side; in fore wing the apex of the spot projecting beyond the rufous border of the discal line, and the lower lobe almost twice the length of the upper one, the lower lobe being also in the hind wing much longer than the upper.]

[Mr. T. Pergande notes that in March, 1896, Dr. B. F. G. Egeling, of Monterey, Mexico, sent cocoons of *R. orizaba*, stating that the natives wore them around the neck, believing them to prevent the growth of beard on the chin. A moth issued May 18.]

Life history.

Larva.—Stage I: Hatched July 8–9. Described July 12, 1902.

Length 8–10 mm. Body cylindrical, rather slender, slightly more so than in *T. luna*. Segments not convex, more as in *Callosamia* than in *Telea* or *Tropaea*. Head rather small, rounded, much as in *Callosamia*, a little more than half as wide as the body in its thickest part; pale whitish, surface very finely granulated; edge of clypeus dark brown, and a transverse line across the front edge; a large brown round spot on each side.

Prothoracic segment with no definite plate, but with six long slender high greenish-yellow tubercles, about one-third as thick at base behind; six setæ in each dorsal tubercle; the longer setæ about twice as long as the tubercles. All the tubercles on the second thoracic segment to the end of the body much swollen at base, being conical, large, and pale straw-yellow, and *all of the same size and height*, but those of the second and third thoracic segments are fused together at their base, while those of the abdominal segments are distinctly separate.

The median tubercle of the eighth abdominal segment is only a little larger and a little broader than those on the ninth segment; those on the ninth abdominal segment fused at base.

Body above black, except the thoracic segments, which are greenish, with two black spots on each segment above; the sutures livid greenish.

Suranal plate with two large, slender, distinct tubercles, about one-half as large as the supraspiracular one on the ninth segment; it is greenish yellow, but behind the tubercles dusky. Anal legs blackish in the middle. Infraspiracular row of tubercles arising from the lateral ridge pale greenish-livid, as is the under side of the body and the abdominal legs. Thoracic legs black.

Each tubercle with six dusky setæ, the longer ones a little longer than the tubercle itself.

A very beautiful caterpillar, which resembles that of *Callosamia* in coloration, but the tubercles are larger, conical, and all alike in size.

Larva.—Last stage: Head rounded, about one-half as wide as the body is thick, and not so wide as the cervical plate; the surface of the head smooth, polished, with scattered fine hairs on the clypeal region and about the ocelli; in color pea-green. Body thick, cylindrical, tapering a little toward each end; how convex the segments are can not be determined in blown examples. Cervical plate smooth, with no vestiges of tubercles. On the prothoracic segment

below the edge of the cervical plate is a slight vestige of a tubercle in front of but a little below the spiracle; farther down, near the base of the leg, is a decided but small low tubercle bearing three setiferous spinules; those in the same relative position on the second and third thoracic segments are of the same size and shape.

On each of the two hinder thoracic segments there are four small dorsal tubercles in a transverse row. Each tubercle is crowned by a ring of five to six spines, with one in the center. These and the dorsal ones on abdominal segments 1–7 are so closely alike in size and armature that it is difficult to see any difference in size between the thoracic and abdominal dorsal ones. The four dorsal ones on each of the two last thoracic and the first seven abdominal segments are alike in size, number, and arrangement of the spinules; there not being the usual distinction which obtains in the Attacinæ (*Samia, Callosamia, Telea*, etc.) between the submedian (dorsal) and supraspiracular series. Those of the seventh abdominal segment are, as far as I can see, just like those on the second and third thoracic and first abdominal segments.

The median spine on the eighth abdominal segment is scarcely higher (longer), but is about one-quarter thicker than the one on each side; it is slightly broader than long (seen in section from above) and bears five spinules on each side of the median line. There is no infraspiracular row of tubercles (such as are present in the Citheroniinæ and Attacinæ). There also seems to be no difference in color between any of the tubercles.

The suranal plate is green, a little rough on the surface, and there are traces along the hinder edge of piliferous spines; the plate is edged with black. The anal legs are large, green, the triangular area edged with black, and on the edge are scattered small black piliferous warts. The thoracic legs are pea-green; the abdominal legs green, with irregular rows of black warts bearing white hairs above the plantæ, which are, with the hooks, black. Along the side of the body extends a broad lateral yellow infraspiracular line, from which and below which arise long fine white hairs. The spiracles are sienna brown-yellow. The body is covered with fine white short clavate hairs. Length 80 mm.

An inflated example from Mexico in the United States National Museum, collection of Dr. H. G. Dyar; two inflated examples, in bad condition, from Tacubaya, Mexico (Barrett).

In the species of this genus the degree of specialization of the tubercles in the larva is very slight, as they show a tendency to reduction and atrophy, which reaches its greatest perfection in *R. betis*, in which there are, according to Burmeister's figure and description, no tubercles at all, while the body is blackish, with conspicuous transverse bands.

R. orizaba, as a larva, in form and markings most nearly approaches that of *R. aurota*, while the most generalized species is *R. speculifer*, in whose larva there are the longest tubercles, most nearly approximating those of *Samia* and *Philosamia*.

Food plant.—Specimens raised from the egg by Mr. Joutel fed on the white ash. Its native food plant is unknown to us.

[The following account of the larva of *R. orizaba* has been kindly sent by Miss Soule.

After third molt.—Head, legs, and prolegs green with black marks. Body very green with almost orange tubercles; that on the dorsum of eleventh segment the largest, those on the dorsum of second and third segments being next in size. Anal plate had a black V and two pale yellow tubercles. The canary-yellow substigmatal "edge" was heavily fringed with white hairs, as were the venter of the thoracic segments and the subventral region. This "edge," almost a ridge, grew pink in color. The spiracles were of just the color of the dorsal tubercles.

The next stage was like this one intensified, and the larvæ grew to a length of 4 inches, measuring 2½ inches around the largest part of the body.—Caroline G. Soule.]

ROTHSCHILDIA JORULLA (Westwood).

Plates IV, figs. 4, 5; V, figs. 1, 2; LVII, figs. 1, 2; LXX, fig. 4.

(*From* Descriptions of some New Species of Exotic Motha belonging or allied to the Genus Saturnia. By J. O. Westwood. Proc. Zool. Soc. London, 1853, pt. 21, p. 159.)

"Saturnia Jorulla, Westw. *S. alis* fulvo-fuscis; anticis macula subtriangulari, posticis macula subovali, vitreis albo nigroque marginatis, striga angulata e basi ad costam anticarum,

alteraque multidentata (communi) pone medium albis nigro roseoque marginatis; striga tenui, nigra, undata, subapicali, macula tripartita, nigra versus apicem connexa; posticis serie submarginali macularum rosearum, extus linea undata, nigra e margine griseo separata. ♂, ♀.

"Expans. alar. antic. maris, unc. 4.

"*Hab.* in Mexico, Cuantla. E folliculo in mense Octobris invento imago prodiit Augusto sequente. Communicavit D. Coffin. In Mus. Westwood.

"This species is allied to *Saturnia hesperus* (Cramer, pl. 68, fig. A), but is smaller, and has the dentated fascia of the fore wings extending in a straight line extirely across them; it is also much more brightly colored. Both sexes have the fore wings emarginate along the outer margin, those of the female being rather less so than those of the male. The general color of the wings is tawny brown; the fore wings with the fore margin thickly clothed with gray scales being white toward the base; the front of the thorax has a continuous white band; another extends also across the hind part of the thorax, and is continued by a white bar along the wing for about one-third of its length, where it is angulated, and extends nearly to the costa; it is inwardly edged with bright rosy, and outwardly in part with black; the vitreous patch which occupies the middle of the wing is subtriangular, having a narrow white margin succeeded by a wider black one. This spot is followed by a multidentate white striga, edged with black on the inside and with rosy red on the out, running nearly in a straight direction across the wing, and extending also in a curved one across the hind wings to the anal margin. This striga is followed in both wings by a rather wide space much powdered with gray atoms, except toward the costa, which is more ashy colored; the dull luteous margin is traversed by a slender, waved, black line, followed by a white band, and toward the tip of the fore wings is a black patch, outwardly dentate, succeeded by two smaller black ones edged with tawny, and a short curved and dentated white line extends to the tip of the wing.

"The hind wings are very similar to the fore ones, having near the base a slightly curved white streak outwardly edged with black, followed by a nearly oval vitreous spot, edged with white and black, slightly larger than the spot of the fore wings; and the luteous margin of these wings bears a slender wavy black line, preceded by a row of small rosy and black spots.

"The wings on the under side are colored exactly as on the upper, except that the costa of the hind wings is narrowly white. The antennæ of the males are but moderately feathered; they are about 30-jointed, each joint producing two branches of equal length on either side, except that in the eight or nine terminal joints one of the pairs of branches is gradually obsolete, being entirely wanting in the six last. The antennæ of the female resemble those of the male, but are rather less strongly feathered."]

[Rothschild (Nov. Zool., 1907, p. 415) has described a subspecies, *R. jorulla inca*, from Peru. He also considers the Venezuelan *R. lebeaui* Guérin to be a subspecies of *jorulla*. On the other hand, the Brazilian *R. prionia* Roths., which greatly resembles *jorulla*, differs in the male genitalia.]

Life history of Rothschildia jorulla.

(*Attacus cinctus* Tepper.)

Larva.—Beginning of stage II: It was hatched in New York from a few eggs laid by examples bred from the cocoon and mated by Mr. Joutel, and sent me May 8, and described May 9. Length 7 mm. Body unusually short and thick, and now much wider than the head, which is of the usual shape (as in *Telea* and *Philosamia*), smooth, with long scattering irregular hairs; antennæ white; it is black and yellowish-white, the sides black, with a black V on each side of the yellow clypeus-posterior; clypeus-anterior with a whitish transverse line.

Body and legs dull livid brownish. The tubercles are very large and crowded together; they are full, globular-conical, and a little higher than thick, and all pale straw-yellow.

There are four dorsal prothoracic tubercles, but the two on each side are united at base making a large double transverse tubercle higher than any of those behind, and all four connected by a ridge; yet they are shorter than in stage I.

All of the tubercles behind the prothoracic segment are of the same size and height, the meso- and the metathoracic ones not differing from each other, nor are the abdominal ones

smaller than those on the thoracic segments, nor do they differ in height or size among themselves, except the median tubercle on the eighth abdominal segment, which is quite broad and one-fourth larger and higher than the others, and about twice as wide as the others; there are six to seven setæ on each side. Those on the sides of all the segments are of the same size.

The dorsal tubercles are each armed with eight stiff setæ, which are pale brown, the longer ones of which are about a third longer than the tubercle itself, one being in the center and the others arranged around it.

On May 17, after being forced by a sojourn in the kitchen, it was ready to molt; its length was 13 mm. The body had now become livid greenish-yellow; the tubercles all straw-yellow, and of the same proportions. The spiracles are dark, rather conspicuous. There is a transverse blackish line on the prothorax behind the four tubercles.

Stage III: It molted May 18, and was described on the 19th. Length 20 mm. Head yellow, black behind, with a broad V in front connecting with the black base of the clypeus-anterior. Body thick, head only one-half as wide as the body in the middle. First thoracic considerably narrower than the second thoracic segment. The tubercles are still all similar, of the same size and color. The two dorsal ones on each side of the prothoracic shield still united. The median dorsal tubercle on the eighth abdominal segment is nearly twice as thick and somewhat higher than those on each side. Each dorsal tubercle bears eight or nine setæ, while on each infraspiracular tubercle are from eight to twelve setæ or spinules.

The body is now black, the sutures between the segments white; the hinder edge of each segment, beginning with the second thoracic, also white. Suranal plate straw-yellow with an irregular longitudinal band, widening behind the two tubercles. The tubercles orange-yellow, straw-yellow at base. Anal legs entirely black. Thoracic legs and antennæ pale at the end; abdominal legs all black. Spiracles black, surrounded by black. It molted May 22–23.

Stage IV: Length 23 mm.; at end of the stage 35 mm. The body is now thick and stout, leaf-green. The head is pale straw-yellow, black behind, inclosing a distinct oblong black spot; clypeus broadly edged with black, making a V. Antennæ and clypeus-anterior whitish.

The dorsal tubercles are all of the same size, and of the same orange color. The spines on those of the three thoracic and first abdominal segments somewhat dusky; those on the tubercles of the segments behind are all pale, while those on the infraspiracular tubercles are a little dusky, as also those of the two dorsal tubercles on the suranal plate. The plate is rather smooth, pale straw-yellow, and bearing along and just outside of the edge a hollow triangular black mark with the corners well rounded. Anal legs green, with a similar but larger hollow black subtriangular ring; the legs below and all the abdominal legs are black with a green spot on the outside of the middle, and bearing long white hairs of even length.

At the end of this stage, May 28–29, it was 35 mm. in length. Now the tubercles are all deep reddish from the top to the base, greatly contrasting with the deep green of the body. The lower edge of the ninth and tenth abdominal segments are now white, forming a broad line.

The front edge of abdominal segments 3–7 whitish. The green spot on the outside of the midabdominal legs is now yellow.

For a day after molting it nibbled its cast skin.

It molted for the fourth time about June 1, and was described June 3.

Stage V: Length 48–50 mm. Head and body deep pea-green, the head green, with two black lines behind, while the clypeus is lined with black. The head is still small in proportion to the body, being about one-third the width of the latter, and only two-thirds as wide as the prothoracic segment. The prothoracic shield is now smooth, with four median minute groups of four to five minute short setæ, and two rounded lateral small tubercles. The *tubercles of the second thoracic segment are smaller than those on the third, the latter not being so high and prominent* as those on the first abdominal segment; those on the thoracic segments are flattened, buttonlike, not so high as thick; all orange-yellow, and bearing from four to seven short black stout setæ, the longest ones no longer than the tubercle is high.

The *tubercles on abdominal segments* 2–7 are smaller *than those on the first abdominal segment,* and gradually become smaller toward the seventh segment. The setæ in general are a little longer than the tubercles are high.

The median tubercle on the eighth segment is low, not so high as broad, and in outline seen from above is transversely oval, bearing four principal larger setæ and three minute ones besides. (The originally double origin of the tubercle is not evident.)

There are on the ninth abdominal segment very minute green vestiges of two tubercles.

Suranal plate green, with a conspicuous white stripe on the edge, and on top of the plate is a subtriangular black mark made by a narrow black line, and a triangular black ring on the outside of the anal legs.

Front edge of abdominal segments 3–7 *with a broad, conspicuous pale purple-madder stripe, which is widest below and narrow above; this is succeeded by a white band, widening dorsally and conspicuous when seen from above.* Spiracles yellow ochre. Thoracic legs green, irregularly ringed with black, the tips black; the four pairs of midabdominal legs black-brown, with an external conspicuous yellowish-green patch, and armed with rather long curved setæ. The plantæ of the anal legs black-brown.

Cocoon.—On the morning of June 13 my larva, which was a little under the normal size, had begun to spin a cocoon, and the handle or stem of the cocoon had been spun before it was nearly finished; the rather large opening for the exit of the moth had been left open..

Number of molts and habits.—There are four castings of the skin and five stages, as usual in the bombycine moths, and the family Saturniidæ. In captivity in a northern State (New York and afterwards Rhode Island), the ecdyses occurred at about every 10 days, the eggs being laid near the end of April and the larvæ hatching out the first of May.

Food plant.—The larvæ were fed on the ash and wild cherry, but preferred the latter. Its native food plant is unknown to us.

ROTHSCHILDIA ERYCINA (Shaw).

Plates XLV, figs. 3, 4; LXX, fig. 3.

Attacus erycina Shaw, Nat. Miscellany, VII, t. 230, 1797.

Phalaena hesperus Cramer, Papillons Exotiques, I, Pl. 68, A, 1775.—Sulzer, Gen. Ins., tab. 21, fig. 2, 1776.—Fabricius, Entomologia Systema, 2d edit., III, p. 408, No. 2, 1793.

Phalaena splendidus De Beauvois, Insectes en Afrique et en Amerique, p. 133. Pl. 22, figs. 1, 2, 1805.

Attacus hesperus Walker, Cat. Lep. Het. Br. Mus., V, p. 1209, No. 8, 1855.

Attacus splendidus Clemens, Proc. Acad. Nat. Sci. Philad., 1860, p. 160. [This is not *splendidus*, but apparently *jorulla* or *orizaba*.—McDunnough.]

Attacus erycina Kirby, Syn. Cat. Lep. Het., I, p. 747, 1892.

Imago.—Two ♂, two ♀. In shape of wings and style of markings allied to the more common *R. orizaba.* Head as usual; color white and a white band at the hinder edge of the thorax as usual. Fore wings falcate, as in ♂ of *R. orizaba* and *R. lebeaui;* not so narrow and produced as in *R. jacobeæ, aricia,* and *arethusa.* The distinctive mark is the shape of the clear discal spots on the fore wings, which are very [?] and oval, not triangular as in *R. orizaba, lebeaui, jacobeæ, hesperus,* and *aricia.* The spot is oval, wide, large, the end toward the base of the wing unusually broad, and varying in the ♀ example from Pulvon, Nicaragua, in being straight and regularly curved, not oblique; in the Texas ♂ it is oblique, but most so in the Brazil ♀; the spot is shortest in the Honduras (?) ♂, longest in the Texas ♂. The subapical spot as in *R. orizaba,* and *lebeaui,* consisting of three black spots; the inner, larger, one wedge shaped, and inserted between the two oval smaller ones; and separated by an S-shaped umber brown line. These spots are very distinct in all except the ♀ from Brazil, in which the two outer spots are obsolete, and the inner one forms a distinct narrow sharp wedge.

The apical region is hoary lilac-pink, in all the specimens the size and color of this area is the same, except in the Brazilian ♀, where it is larger and more ferruginous.

The basal line is as in *R. orizaba,* pointed and a little produced as usual toward the discal spot. Extradiscal line in its course and degree of scalloping much as in *R. orizaba;* between

the outer end of the discal spot and the costal edge are two slightly marked scallops; the line here is slightly incurved; more so in the West Nicaraguan and Honduras(?) examples; still more distinctly incurved in the Texan, and also irregularly indented, and wanting the two distinct scallops; in the Brazilian ♀ the line here is more deeply and distinctly incurved, and not subdentate or scalloped; behind the discal spot the line consists of 3 one-half scallops; these not varying much in the different specimens. The line is white, indistinctly edged within with blackish, and externally with a broad, distinct reddish orange-brown band, and beyond this are no lilac and black scales such as occur in *R. orizaba* and *lebeaui;* the narrow submarginal line as in *R. orizaba,* not formed of double scallops as in *R. lebeaui.*

Hind wings with the discal spot large, oval in all the examples, the outer end entering the white extradiscal line a little way. The clear discal spots are as large and wide as in any species; they vary somewhat in examples from different localities; in the Honduras (?) ♂ they are shortest, and longest in the Texas ♂, and tapering on the outer end; most distinctly oval in the Brazilian ♀. The extradiscal line with one well-marked scallop between the discal spot and costa; behind the discal spot it consists of three scallops, which are sharp, triangular in the Honduras(?) ♂, rounded in the West Nicaraguan, Texan, and Brazilian examples.

The marginal row of 15 black and red spots are as usual, separate in the Brazilian ♀, more inclined to be all brick red.

Beneath as above, with a faded hue.

Expanse of the fore wings, ♂ 110–125 mm.; ♀ 150–155 mm.
Length of one fore wing, ♂ 60–65 mm.; ♀ 70 mm.
Breadth of one fore wing, ♂ 31–33 mm.; ♀ 35 mm.
Length of a hind wing, ♂ 45–48 mm.; ♀ 52–57 mm.
Breadth of a hind wing, ♂ 30–33 mm.; ♀ 35 mm.

The Brazilian ♀ appears to indicate a distinct climatic race, or else the Brazilian example is the primitive form, and the Texas and Central American individuals belong to local or climatic races.

Geographical distribution.—Texas to Brazil; Texas, Clemens, Captain Pope's collection (Museum Comp. Zoology, given by Clemens to John Morris); Honduras (?) (Doll): Pulvon, West Nicaragua (McNiel, M. C. Z.); Brazil, compared and agreeing with, with two examples from Brazil in the British Museum. My identification of this species is based on the specimen labeled "*Attacus erycina* Shaw" in the British Museum. Mr. Hulst at a meeting of the Brooklyn Entomological Society "mentioned that it had been proved by breeding that *Attacus splendidus* and *orizaba* were identical." (Ent. Amer., I, p. 160, November, 1885.) This would seem to be an error and to need confirmation.

[Rothschild, in *Novitates Zoologicae,* XIV (1907), has described four subspecies of *R. erycina:*

Rothschildia erycina nigrescens. ♀. Tuis, Costa Rica.

Central area of both wings much washed with black; the pinkish discal area narrower than the space from this band to the margin of the wing; outside this pinkish area, which on fore wing extends to the tip of the transparent spot, there is a brownish black band, which extends forward to R, on hind wing. Between this band and the margin the fore wing bears vandyke-brown patches, followed by a drab band, while the hind wing has a row of large black double spots, outside which there is a row of heavy black bars; transparent spots smaller than in *R. e. erycina.* The underside shows similar differences from *R. e. erycina.*

Rothschildia erycina martha. ♀. Onaca, Santa Marta.
Rothschildia erycina vinacea. ♂, ♀. Peru.
Rothschildia erycina luciana. ♀. Sta. Lucia.]

[Mr. C. L. Pollard considers that *R. splendida* is a distinct species, and writes as follows (litt., July, 1912) concerning it: "This has nothing to do with *orizaba,* nor is it a synonym of *erycina,* as some have contended. It is found only at the Isthmus, apparently, my specimen

having come from the Canal Zone. It may be distinguished from *erycina* by the uniformly dark, smoky brown color, approaching that of *lebeaui;* by the small size and narrower primaries; and by the relatively conspicuous double row of submarginal black spots on the secondaries. The vitreous spots are entirely different in shape, being triangular and more or less acute-angled. There is the same ovoid-oblong, pale brown, suffused area on the apical third of the primaries as in *erycina.*"]

ROTHSCHILDIA BETIS (Walker).

Plate XLV, fig. 1; XLVI, fig. 7.

ROTHSCHILDIA ARICIA (Walker).

Plate XLVI, fig. 4.

ROTHSCHILDIA HESPERUS (L.).

Plate XLVI, fig. 5.

ROTHSCHILDIA LEBEAUI (Guér.).

Plate XLVI, fig. 6.

ROTHSCHILDIA JACOBÆÆ (Walker).

Plate XLV, fig. 2.

Attacus jacobææ, Walker, Cat. Lap. Het. Brit. Mus., V (1855), p. 1219.]

The materials on which our life history of this species is based were obtained by the American Museum of Natural History from Buenos Aires. It consisted of the eggs, inflated larvæ in three stages, the pupa, cocoon, with ♂ and ♀, all in an excellent state of preservation, and I am indebted to Dr. H. C. Bumpus, the director of the Museum, and Mr. William Beutenmüller, the assistant in charge of the Department of Entomology, for loan of the specimens.

Eggs.—Oval, flattened, chalky white; surface shining, seen under the lens to be very finely pitted; greatest diameter about 2 mm.

Larva.—Stage II: The blown larva in the third stage had retained on the last half of the body the skin of what we suppose to be this stage. It shows, what is not present in the next stage, *two parallel rows of six linear black spots passing across the segments.* On the suranal plate, on each side, is *a low flattened green tubercle, bearing six dark spine-like setæ.* There are faint traces of a reddish spot on the plate, and on the side of each anal egg. *All the tubercles black.* The median tubercle on the eighth abdominal segment slightly bilateral, bearing four setæ on each side. Suranal plate with a yellow band on the edge.

Stage III: What is probably of this stage is a blown larva. Length of body 34 mm. width of head 2.7 mm. Head pale yellowish brown (probably green in life), clypeal sutures black, and on each side is a black line extending from the eyes up to the center of the vertex on each side.

Body green; cylindrical, with prominent tubercles as in the corresponding stage of other Attacine larvæ. Prothoracic plate with four well-developed green tubercles, which are low, rounded, about half as large as those on the second thoracic segment, and each bearing six dark setæ. Tubercles of the second and third thoracic segments, each with fairly large green warts or tuberculets, each bearing a black seta longer than the main tubercle, at least a third longer. Those of the first abdominal segment a little larger than those on segments 2–7.

The median tubercle on the eighth abdominal segment double, and apparently as large as the thoracic ones (this is covered by the loosened skin of the previous stage). Legs as in the last stage, but the midabdominal ones not so much black in extent at the end. Spiracles black. The yellowish rings of the later stage are in this period faint.

Stage next to the last: Length of body 70 mm.; width of head 4 mm. Head and body pea-green, as in the last stage. On the prothoracic segment the position of the primitive dorsal tubercles (seen on stage III) is indicated by minute setiferous warts. Dorsal tubercles on the

second and third thoracic segments a little (about one-fourth) larger than those on abdominal segments 1–7; those on the latter-named segments slightly larger than those on the intermediate segments, all bearing six radiating and a central erect black seta; the tubercles are pale green (in the blown larvæ examined they have turned yellowish like the dorsal ones).

The median tubercle on the eighth abdominal segment of the same size as those of the dorsal on the second thoracic segment; it shows a slight bilateral arrangement, there being six black setæ on each side.

Suranal plate and each of the anal legs with a pale bright red spot as in the last stage. Spiracles black; legs as described in the last stage.

The larva in this stage differs from the full-grown caterpillar in the larger tubercles, all of which are armed with well-developed spine-like setæ; in the nine (one more than in the last stage) yellow bands, there being an additional one on the second throacic segment, the bands or incomplete rings beginning at the infraspicular row of tubercles and passing over the back from one side to the other.

Last stage: Length of body 110 mm.; width of head 4½ mm. Body cylindrical. Head small rounded green, smooth, less than one-half as wide as the prothoracic segment; the clypeus narrowly edged with black, and two diverging black lines extending from near the center of the vertex and passing down inside of the ocelli.

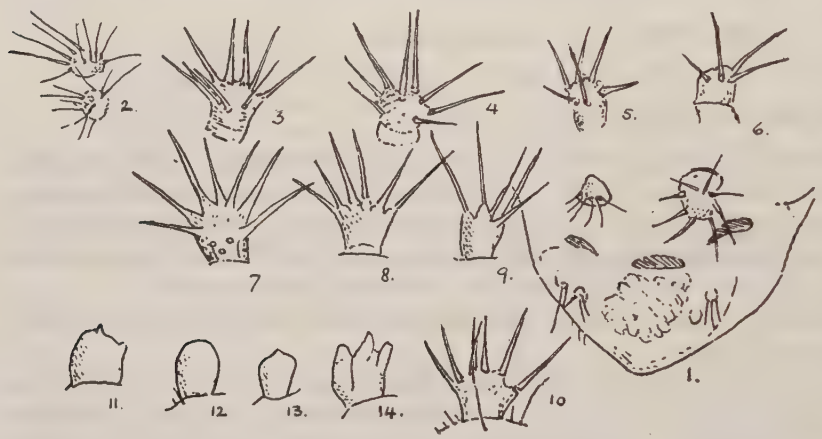


Fig. 33.—*Rothschildia jacobææ*. Larval tubercles. 1. Stage II, suranal plate. 2–6. Stage III; 2, prothoracic plate, two tubercles on one side; 3, from second segment; 4, from third thoracic; 5, from first abdominal segment; 6, from eighth abdominal. 7–10. Stage IV; 7, from second thoracic segment; 8, from third; 9, from first abdominal; 10, from eighth abdominal. 11–14. Last stage; 11, from second thoracic; 12, third thoracic; 13, first abdominal; and 14, eighth.

Prothoracic segment with no traces of dorsal tubercles, but a green pyriform tubercle in front of and a little below the spiracle, and a larger, more prominent one, still lower down, bearing six short setæ, five around the edge of the crown and one in the center.

Dorsal tubercles small pyriform, present on the second and third thoracic segments; those on the first abdominal segment about a third smaller than the thoracic ones, and with no setæ. On abdominal segments 2–7 the dorsal tubercles decrease in size to the seventh. The median tubercle on the eighth abdominal segment dark green, fully as large as the thoracic ones, and bearing five distinct peripheral and central one black seta (their stumps being present, probably broken off while being inflated; they are faintly seen in the penultimate stage.) Tubercles of the supraspiracular row minute, smaller than the dorsal ones; those of the infraspiracular row larger, and still armed with 7–8 black setæ. It differs from the larva of *R. orizaba* from Mexico in having no definite hairy lateral yellow ridge.

Suranal plate small, rounded behind, with a few small fine hairs and bearing a large central bright red rugose spot; the lower edge yellow; on the sides of the anal legs a little larger triangular spot of the same color. Spiracles black, very conspicuous. Segments smooth, and with a pale yellowish band or incomplete ring (eight in all) in front of each spiracle.

Thoracic legs pale, black at the end, first and the third joint entirely black. Midabdominal legs green, a yellow patch above the planta, broadly bordered with black, and the planta black.

Described, as are the other stages, from blown specimens.

It differs in this stage from the larva of *R. orizaba* in the abundant hair-like setæ on the lateral ridge, and in the red spots on the suranal plate and side of the anal legs. In its armature it differs from that species.

Cocoon.—Oval, not much larger at one end than at the other; the stalk very slightly developed. Length 53 mm., thickness 21 mm.

Pupa.—Of the form of *cynthia*, but not so thick; of the usual chestnut brown color. Length 28 mm., thickness 13 mm.

ROTHSCHILDIA JACOBÆÆ AMAZONIA (Packard).

Plate LXIV, fig. 1.

[*Attacus*] *amazonia* PACKARD, Rep. Peabody Acad. Sc., 1869, p. 85.

On further examination of the type of my description it seems to be a form of *R. jacobeæ*. It differs from an example of *R. jacobææ* from Rio Grande, Brazil, and three others presumably from the Brazilian coast, in the following respects:

The fore wings are much elongated toward the apex, and much more falcate, being broadly and deeply excavated on the outer edge of the wing. The discal spot is narrow and elongated, the inner end acute, and much prolonged, the outer end passing through or interrupting the extradiscal line; the latter line is more deeply scalloped; the costo-apical clear reddish space, so distinctive of *R. jacobææ*, is in *amazonia* still longer. (The subapical spots are rubbed off.)

The discal spots of the hind wing are larger, broader, more oval, than in *R. jacobææ*, not so sharp, much fuller and rounder at the outer end. The abdomen is marked by two white longitudinal lines as in *R. jacobææ*, these lines not occurring in any other species examined by me and thus apparently diagnostic of the species.

In the shape of the wings this type is very close to Felder's *Attacus satyrus*, only differing in markings in the somewhat broader discal spot of the hind wings, while that of the fore wings is a little longer.

This may prove to be a local race. It is distinguished from *jacobææ* by the very long and narrow fore wings, and the long broad discal spots of the hind wings.

Geographical distribution.—Collected by Prof. James Orton at Pebas, about 2,000 miles from the mouth of the River Amazonas. The type is in the Museum of Harvard University, Cambridge.

COSCINOCERA Butler.

[*Coscinocera* BUTLER, Proc. Zool. Soc. Lond., 1879, p. 163.]

Rothschild (Nov. Zool., II, 1895) recognizes only one species, *C. hercules* (Misk.) from Queensland and New Guinea. *C. omphale* Butler [New Ireland] is a synonym of *C. hercules*. An example from German New Guinea, with all the ocelli much smaller, and nearer the base of the wings, is described as ab. *butleri* Roths. [More recently (Nov. Zool., VI (1899), p. 70) Rothschild has added a form named *C. hercules heros* Roths.]

Of the species of *Attacus*, this remarkable tailed form *C. hercules* approaches nearest *A. crameri* Felder from Amboina. The body and antennæ, the fore wings in their shape and markings, are very much like the Amboina species, while the wing in *Coscinocera*, however, lacks the subapical ocellus, unless a slight vestige is left, but has retained the zigzag diffuse white line. The discal spots are much as in *A. crameri*, being triangular, small and with a whitish triangular center.

The chief generic difference lies in the very long tails of the hind wings, which are fully as long as the main part of the wing itself; they are narrow and slightly bent outward near the end. The female differs much, according to Oberthür, from the male.

Geographical distribution.—All the species belong to the Notogaeic realm, Cape York, and islands north and east of New Guinea.

This genus is evidently an offshoot from a *crameri*-like *Attacus*, and it may be questioned whether the tails are not the result of some sport, which has become fixed by heredity. *A.*

crameri is evidently the most extreme and recent form of *Attacus*, and an islandic offshoot of the genus.

COSCINOCERA HERCULES (Miskin).

Plate LXXXIV, fig. 1; LXXXV; LXXXVI.

Attacus hercules Miskin [Proc. Ent. Soc. Lond., 1875, p. XXVI].—Oberthür, Études d'entomologie, liv. XIX, p. 34, Pl. 1, ♂, fig. 1, 1894.

[Watson, Wild Silk Moths of the World (Manchester, 1912), Pl. I, gives good colored figures of both sexes.]

Geographical distribution.—[Australia]; Ansus, Jobi Island, northern New Guinea (Doherty, Oberthür).

ATTACUS Linné.

[*Attacus* Linné, Syst. Nat., I (1767), p. 809.]

[Mr. Watson contributes the following notes on *Attacus*:

The group of genera which at one time comprised the genus *Attacus* have lately been rightly separated in the different zoographical regions of the globe into various genera, and no doubt even more will be done in this way in the near future with other large genera as life histories have been studied and worked out. As at present constituted the genus *Attacus* is composed of two small groups of genera forming two sections; these are *Attacus* proper, of which the type is *atlas* (L.), with its many geographical races or subspecies, and of which I now describe a new subspecies from the Andaman Islands, and the small group which I call *Archeoattacus*, the type of which is *A. edwardsi* (Wht.). If we compare the representatives of the different Asian genera together in both sexes, such as *A. atlas* (L.), *A. lorquini* (Feld.), *A. edwardsi* (Wht.), *Coscinocera hercules* (Misk.), and *Drepanoptera vacuna* (West), it will be seen there are two distinct types here represented. It is likely that *Attacus* is a derivate from the *Actias* group of genera through *Argema*, *Coscinocera*, and *A. lorquini*, the female of which with its long drawn out hind wing is seen to approach *Coscinocera*. It will be noticed the type of coloring and general appearance of *A. atlas*, *lorquini*, *dohertyi* (Roths.), and *Coscinocera hercules* are all [of] one character and separated easily from *Drepanoptera vacuna*, *Archeoattacus edwardsi*, and *Philosamia walkeri* (Feld.), which last few genera form a little group with general resemblances peculiar to themselves.

It is not beyond impossibility that the similarity of the *Attacus* group, including *Coscinocera*, to the *edwardsi* group is a case of Müllerian adaptation; the strong pungent scent given off by *A. edwardsi* and from which I can tell fully 24 hours before a moth emerges, a scent which is not given off to my knowledge by any of the many subspecies of *atlas* which I have hatched, but given off by *Philosamia*, may have something to do with it.

Rothschild's plate of *A. staudingeri* in Novitates Zoologicæ, 1895, Plate 10, figure 2, shows the forked costa, the less highly pectinated antennæ, the postdiscal white fascia curving *outwards* towards the apex, and the distinctive variations between the width of the subcostal veins. I have not seen *A. staudingeri*, but the illustration on Plate 10 is evidently perfectly trustworthy, the characters there found agreeing accurately with *edwardsi*. The plate shows the two forms of antennæ side by side; it figures *A. dohertyi* and *Archeoattacus staudingeri*.—J. H. Watson.]

ATTACUS ATLAS Linné.

Plate XXVI, fig. 1; XLVI, fig. 3; LXXXVIII, fig. *e*; LXXXIX; XC; XCI, fig. *a*.

[*Bombyx atlas* Linné, Syst. Nat. (1758), I, p. 495.]

In its venation and in the antennæ and other characters, imaginal and larval, the Asiatic species of *Attacus* differ markedly from those of the new world, or Neogaea, and should be separated generically. If we are in doubt as to the generic value of the adult features, the larvæ are certainly very different, and can not be included in the same category with the Neogaeic caterpillars. It was not until I had decided that the Asiatic forms were generically different from the American species, that I met with the suggestion of Sonthonnax. [This was written before Grote proposed the name *Rothschildia* for the American forms.]

In the markings there are constant differences between the species of *Attacus* as here restricted and *Rothschildia*.

The presence of a lanceolate oval clear spot, thinly covered with whitish-yellow scales, in the last subcostal cell, shows that *A. atlas* is more specialized than the American species heretofore referred to *Attacus*. There are two triangular clear discal spots in each wing, and nearly of the same size, neither quite reaching the extradiscal line, those of the hind wings nearly as wide as long. The apical spot is a large ocellus, situated next to the costa just before the apex; it is a large round black spot nearly reaching to the costal edge, and bordered with steel blue. There is a good deal of instability in the apical markings. In *Rothschildia* the ocellus is (*R. jacobeæ* and *orizaba*) in the second cell, but in *A. atlas* it is wanting, there being only a deep Indian red slash, ending in a fine line passing to the outer edge of the wing; while there is a conspicuous ocellus-like roundish black spot on the first cell next to the costa, edged externally and beneath with white.

The usual marginal sinuous dark-brown line is present as it is in *Rothshcildia;* there are only three lines crossing both pairs of wings. Both wings are much paler beneath than above, but it is not so in *Rothschildia;* the basal line in both wings is nearly obsolete; the extradiscal line is fainter, while the wing area between these two lines is dusky; the apical markings are as distinct as above.

Attacus atlas is evidently the end or terminal twig of a series of Attacine forms, both in its larval and adult characters. Its great size is a feature of its specialization, as the big mammals, such as the elephant, hippopotamus, rhinoceros, whales, etc., are the result of extreme specialization, induced in part by overfeeding or at least a surplus of food and more or less sedentary habits.

[Attacus atlas mcmulleni Watson, subsp. n., Pl. XCI, fig. *a*.

Male: Fore wing, apex more pointed than any of the other races of *Attacus atlas*, apex more tawny. Central area of wings warm reddish brown. The basal and the post discal red line almost without white border and faintly edged with black, not so curved toward the base of wing; beyond this line the wing is very regularly dusted with yellowish scales, except a narrow border of the usual gray dusting. One vitreous spot and trace of a second vitreous spot, small and with the longest line below and nearest the outer margin of the wing. The basal area of wings hardly differing from the central area in color. The outer margin of the fore wing olivaceous and the wavy line black and deeply sinuated. Hind wing, outer margin curved, never straight, similar in coloring to the fore wing with a prominent black submarginal line; edged inward with crescents of brownish red edged with tawny. The vitreous spot small and sharply triangular, of three straight lines with a black border having straight edges, post discal red line as forewing.

Female: Fore and hind wings general color deep brown, less red than female, apex tawny gold, almost orange where the brown streak is. Forewing, the single vitreous spot would be equilateral, but the basal side is curved outward toward the base of the wing. Post discal line bright red, almost of a sealing-wax red, edged inwardly with less white than the *atlas* females usually have; outward the black and white dusted area shading to deep brown and toward outer margin of wing are tawny irrovations between the veins. The olivaceous margin with a very faint slightly wavy black line. Hind wing very rounded; the vitreous spot has the two outer sides straight; the basal side two-thirds straight and then elbowed to the subcostal vein. Post discal red line as fore wing. The submarginal spots are brown, edged broadly with tawny gold. On the under surface these submarginal spots are very large and inward is a narrow abrupt band of deep brown. In most races of *atlas* this band is suffused into the irrovated or dusted area. In this subspecies it is abrupt on both the hind wings and forewings. The spots on the abdomen very large, larger than any subspecies of *atlas* which have seen.

Types in collection of I. Henry Watson.

Eight males and one female Port Blair, Andaman Islands; four of the males collected by Mr. McMullen and four males and one female, bred J. H. W. from cocoons sent me from larvæ taken near Port Blair, Andaman Islands; three males ex Port Blair, Andaman Islands; one male ex Port Blair, Andaman Islands (McMullen), in collection of Rothschild.

Mr. McMullen (in litt.) tells me "I have found the *Attacus* on the Samalu hedges. This tree grows extensively in south India, around villages. I have found most on a wild trailing plant of which I do not know the name. I will send you pieces of these." Further he says that the female larvæ which he has found for me are 8 inches long, slightly stretched when feeding. The cocoons, of which I have some, are about the size of wild cocoons of *atlas;* the silk, however, is coarser and very dark brown, similar to that of the Bornean *atlas*. There are at least two broods per year. The cocoons which I have received are enveloped in sometimes single leaves and sometimes two or three, which resemble in method of growth bramble leaflets; the upper surface when dried is very dark green and the under surface is white and woolly.—J. H. Watson.]

[Rothschild states (Nov. Zool., II, 1895) that *Attacus lorquinii* Felder, from the Philippines, is a valid species, not a subspecies of *A. atlas*. It is known as the ilang-ilang moth in the Philippine Islands; cf. A. F. Navarro, Philippine Agr. and Forester, I (1911), No. 2.

Fruhstorfer (Ent. Meddel., II (1904), pp. 283–290, and Soc. Ent., XVIII (1904), p. 169) has described various subspecies and varieties of *A. atlas*.]

ATTACUS CAESAR Maass. and Weym.

In *Attacus caesar* Maass. and Weym., from Mindanao, Philippines, there is a still greater specialization of the clear discal space and its outlines, there being in ♀ two instead of one accessory cell, one in each of two last subcostal cells, and ocellus in hind wing merges into a white branched extradiscal band which passes down to the inner edge of the wing. The male is very different, the ocellus is divided into two small remote spots, and there is only one triangular small spot in last subcostal cell.

Length of forewings, ♂ 11½ cm.; ♀ 12 cm.

ATTACUS EDWARDSII White.

Plate XLVI, fig. 1; LXXX, fig. 9; LXXXVII; LXXXVIII, figs. *f*, *g*; XCI, fig. *b*.

Attacus edwardsii White, Proc. Zool. Soc. London, p. 115, Pl. LVII, 1859.—Moore, Cat. Lep. Mus. E. I. House, II, p. 406, No. 928, 1859.—Butler, Illustrations of Lep. Het. Brit. Mus., V, p. 60, Pl. XCII, ♂; XCIII, ♀, 1881.—Kirby, Syn. Cat. Lep. Het., I, p. 745, 1892.

[*Geographical distribution.*—North India.]

[Mr. J. H. Watson proposes a new genus for *A. edwardsii* and *A. staudingeri*, as given below.]

ATTACUS DOHERTYI Rothschild.

Attacus dohertyi Rothschild, Nov. Zool., II (1895), p. 36, Pl. X, fig. 1, ♂.

Geographical distribution.—Timor and Flores. [Rothschild (1910) has described a subsp. *wardi* from Port Darwin, Australia.]

ATTACUS AURANTIACUS Rothschild.

Attacus aurantiacus Rothschild, Nov. Zool., II (1895), p. 36.

Geographical distribution.—Northwest New Guinea.

ATTACUS STAUDINGERI Rothschild.

Attacus staudingeri Rothschild, Nov. Zool., II (1895), p. 36, Pl. X, fig. 2, ♂.

Geographical distribution.—Northwest Java.

ATTACUS CRAMERI Felder.

Plate XLVI, fig. 2.

[*Attacus crameri* Felder, Sitz. Akad. Wiss. Wien., XLIII (1861), p. 31; Amboina.

Attacus (?) *cydippe* [Druce, Ann. Mag. Nat. Hist. (6) XIII (1894), p. 178; Mexico] is not an *Attacus*. It is small, and has *a median line just outside of lanceolate white ocelli*, and an extradiscal band.

[ARCHÆOATTACUS Watson.

Archæoattacus nov. gen., type *Attacus edwardsi* (White), Proc. Zool. Soc. Lond. 1859, Pl. XLVI, fig. 1.

I am forming this genus to include *A. edwardsi* (White); *A. staudingeri* (Rothschild, Nov. Zool., vol. 2, 1895, p. 36) and probably a new smaller species, as yet undescribed, from Thibet, which M. Charles Oberthür has shown me in his collection. This genus was indicated by myself as a subgenus in the transactions of the Manchester Entomological Society, 1910, and is more closely allied in all its stages as far as known to the genus *Philosamia* (Asian), *Drepanoptera* (African), and *Samia* (American), and I have therefore proposed for these two or possibly three species generic rank, with which Mr. Oberthür concurs. Antennæ of the female less deeply pectinated than *Attacus* proper.

Body as in *Philosamia*, longtitudinally striped (*edwardsi*). Pupa (*edwardsi*) without armed ventral processes as in *Attacus*. Ova much smaller than *Attacus;* less rounded. Costal vein of fore wing separated from the first subcostal by nearly twice the distance as between the second and third equidistant in *Attacus;* a short spur given off near the apex more abruptly than in *Attacus* proper, making the wing apex slightly lobed.

The white fascia beyond the vitreous disk in this genus and the three other genera above mentioned curves outwardly toward the apex of the forewing; toward the base in *Attacus* and *Coscinocera*. In the figure of *edwardsi* male in Sonthonnax's Lab. d'Etudes de la Soie, Plate XII, the antennæ are much too wide and quite out of all proportion to the actual thing.—J. H. Watson.]

HYBRID SATURNIIDÆ.

Plate LXXXVIII, f. c. d.

[The Saturniidæ have produced many hybrids in captivity. Descriptions of these hybrid larvæ are given below, but in the two cases where the parents were of different genera, one of them being *Callosamia promethea*, the larvæ were like *promethea*.[1] In one of these cases the *promethea* parent is stated to be female, in the other no statement concerning sex is made. It seems very possible that these are "false hybrids," which always exactly reproduce the specific characters of the female parent.

The species of *Samia* and *Saturnia*, especially, cross freely in captivity. Thus in *Samia* the following hybrids have been described: (1) *cecropia* ♂ × *gloveri* ♀; (2) *cecropia* ♂ × *rubra* ♀; (3) *columbia* ♂ × *cecropia* ♀; (4) *rubra* ♂ × *cecropia* ♀. Special names have been given to these hybrids by Tutt.

Tropæa luna ♂ has been crossed with *Actias selene* ♀, a fact which may be used in support of the view that *Tropæa* is a synonym of *Actias*.

The hybrids of *Saturnia* are very numerous and complicated, and have especially been investigated by Dr. M. Standfuss of Zürich, whose truly astonishing collection I have examined. Some of the principal crosses are as follows: (1) *pavonia-minor* ♂ × *spini* ♀; (2) *spini* ♂ × *pavonia-minor* ♀; (3) *pavonia-minor* ♂ × *pavonia-major* ♀; (4) *pavonia-major* ♂ × *spini* ♀; (5) *pavonia-major* ♂ × *pavonia-minor* ♀; (6) *atlantica* × *pavonia-major*. For the last see A. Ebner, Intern. Entom. Zeits., v (1911), p. 158. Several of these hybrids have proved fertile, and so it has been possible to produce a form derived from three different species, or cross back the hybrid with one of the parent species, as follows:

(1) Hybr. *bornemanni* Stdfss. (ex *pavonia-minor* ♂ × *spini* ♀) ♂ × *pavonia-minor* ♀.

(2) Hybr. *emiliæ* Stdfss. (ex *pavonia-minor* ♂ × *pavonia-major* ♀) ♂ × *pavonia-minor* ♀.

(3) Hybr. *emiliæ* Stdfss. ♂ × *pavonia-major* ♀.

(4) Hybr. *bornemanni* Stdfss. ♂ × *pavonia-major* ♀. This is the hybrid derived from three species.

(5) Hybr. *bornemanni* Stdfss. ♂ × *spini* ♀.

(6) Hybr. *standfussi* Wiskt. (ex *emiliæ* ♂ × *pavonia-minor* ♀) ♂ × *pavonia-minor* ♀.

[1] [Miss Soule, however, refers to a "*cynthia* form" of larva, as well as a "*promethea* form," obtained from the cross *cynthia* ♂ × *promethea* ♀.]

It is probably significant that in these complicated crosses the hybrid is always the male parent.

The most remarkable cross made by Standfuss was *Saturnia pavonia-minor* ♂ × *Graellsia isabellæ* ♀, but it could not be raised to maturity.

(For details concerning the work of Standfuss, see Proc. Seventh International Zoölogical Congress, published at Cambridge, Mass., 1912, pp. 111–127.)

Mr. J. H. Watson (Nov. 2nd., 1912) has described a hybrid between *Caligula japonica* and *C. simla*, obtained under experimental conditions. Two female moths secured were both sterile.]

PHILOSAMIA CYNTHIA [i. e., WALKERI] ♂ × CALLOSAMIA PROMETHEA ♀.

Plate LXXI.

Larva.—Stage III: Length 15–17 mm.; head 2½ mm. in width, with two black bands separated by a straw-yellow one. Five larvæ molted July 29–30.

Body now more white and covered with a white powder. In all of them the black stripes are present, but not quite so wide as before. The four thoracic and the eighth median dorsal tubercles much larger than the others and *bright lemon-yellow*, as are the end of the abdominal median and anal legs. It differs from my description of *C. promethea* in the black rings being present, two on each segment as before. The curved black line on the outside of the anal legs boomerang-shaped or crescentiform. Two dusky dots on each side of the midabdominal legs. The black curved spot on the suranal plate is as in stage II. In two of them the second thoracic dorsal tubercles are black, so that there are only two lemon-yellow thoracic tubercles.

Stage IV: Molted again August 4. Length 17–18 mm.

Head yellow, black across in front of the clypeus, with a black dot on each side, back of the head toward the occiput black. Now there are *no black bands*, the four thoracic dorsal tubercles are high, *deep orange* and black at base, the median tubercle on eighth abdominal segment *greenish-yellow*. All the other tubercles black. Suranal plate with two large black tubercles, behind which the surface of the plate is orange; end of the plate with a transverse black line. On the outside of the anal legs a long narrow, much curved black line, much narrower, more linear, than in stage III.

The body is now whitish, the hinder edge of the abdominal segments greenish. (It died after molting; agrees exactly with my description of *C. promethea*, stage IV.)

[The following from Herman Strecker (litt., 1900) requires further elucidation:]

"You know *cynthia* crosses with *promethea*, but the product from the act being done in a state of nature is widely different from that produced by pairing in confinement or by artificial inducement. The first is a curious thing; color of *cynthia*, with discal marks [and] shape of *promethea* ♀. Those bred in confinement produced things (♂) looking like ♀ of *promethea* nearly, only blackened, not reddish."

PHILOSAMIA HYBRIDS.

Plate XCIII, figs. j, k, l, m.

Watson, Wild Silk Moths of the World (1912), Pl. III.

[The species of Asian *Philosamia* interbreed with one another and produce fertile hybrids. During the last two or three years I have produced hybrids of *vesta*, which used to be reared extensively in France 40 years ago. This is the result of *P. walkeri* (China) × *P. ricini* (Hutt) (Bengal and Assam). This hybrid as reared by myself has two distinct forms; form *vesta* partaking of the *ricini* side (some specimens of which I have seen in Mr. Rothschild's collection from the Elwes collection) and a form which I have named *russelli*, after Dr. Russell, of Lincoln, who has reared it at the same time as myself. It approaches in appearance more to *walkeri* and is a well-marked mutative form. It, as well as the *vesta* form, may be transmitted to other generations.

Both these forms of *walkeri* × *ricini* hybrids may be distinguished from *walkeri* by the bodies of both sexes being more white. The body of *ricini* male is wholly white and the female nearly so except that the sides have buff-colored spaces between the tufts of white. I have crossed these hybrids in both forms and both sexes with *walkeri* and *ricini* again; and the progeny which are fertile are ¾ *walkeri* and ¼ *ricini*, and others ¼ *walkeri* and ¾ *ricini* are again fertile; I have progeny from ¾ *ricini* × ¾ *ricini* and ¾ *walkeri* × ¾ *walkeri* and again ¾ *ricini* × *walkeri* and vice versa. The *walkeri* × *ricini* hybrids pair together freely and are very fertile. The Agricultural Research Institute of Pusa, Bengal, from these primary crosses of mine have selected two races which produce rusty red cocoons and white cocoons and by selfing these have now two distinct races for distribution amongst the Eri silk rearers of India.—J. H. Watson.]

[Since writing the above, Mr. Watson has reared a new hybrid, *P. walkeri advena* ♂ × *pryeri* ♀, which he calls *pryadvena;* also one with the composition $\left(\frac{\textit{cynthia advena}\ ♂}{\textit{ricini}\ ♀}\right)$ ♂ × *pryeri* ♀, which he calls hybr. *lefroyi*.]

CALLOSAMIA PROMETHEA × SAMIA GLOVERI.

Young larva.—Looks so far as I remember like *promethea.* Head black, a white line across front, and labrum white; setæ all black, tubercles livid black; hind edge of prothoracic segment black, forming a wide black band; meso- and meta-dorsal tubercles black. Abdomen with dorsal tubercles yellow like body, each segment with front and hind edge black, the black band in front scalloped on hinder edge.

Received from Miss Soule. Hatched June 20, 1901.

SAMIA CECROPIA ♀ × S. GLOVERI ♂.

Larva.—Length 60 mm. Head yellowish green; body bluish, glaucous, green; a decided *bluish* tint. Prothoracic plate greenish, the four tubercles on it black, the two on each side turquoise, pale toward end, black at base as on all the other tubercles, i. e., those of the two lateral rows. Those of the two dorsal rows to and including abdominal segment are straw yellow, as is also the median tubercle on eighth abdominal segment. In all the tubercles the spinules are black; one (right one) of the tubercles on suranal plate is black (diseased).

Abdomen and thoracic legs apple green. Spiracles [with] a fine black ring. No *red* tubercles! no green tubercles! Compared with my description of normal *cecropia* the prothoracic dorsal tubercles are black not "blue."

Six thoracic dorsal tubercles are straw yellow, not "reddish," but abdominal dorsal ones are as in my description of normal *cecropia,* yellow, including median one of eighth segment. Tubercles of two lateral rows are "bright blue," i. e., turquoise, rather pale as in normal *cecropia.* The tubercles on ninth segment as in normal *cecropia,* blue, and so are all the feet.

Food, wild cherry. Received from Joutel, July 26, 1901.

SAMIA CECROPIA ♂ × S. COLUMBIA ♀.

Larva.—Plate V, fig. 3.

PARASITES.

HYMENOPTERA.

ICHNUEMONIDÆ.

[Especially characteristic are certain members of the tribe Ophionini, which has recently (Trans. Am. Ent. Soc., 1912) been revised by Mr. C. W. Hooker. The species reported from Saturniidæ (s. lat.) are as follows:

(1) *Eremotylus arctiæ* (Ashmead). From *Automeris io* (cf. Ashmead) and *Callosamia promethea* (cf. Felt).

(2) *Eremotylus macrurus* (L.) (*Ophion macrurum* auctt; *O. cecropiæ* Scudder), from *Automeris io* (cf. Felt), *Callosamia promethea* (cf. Webster), *Samia columbia* (cf. Felt), *S. cecropia* (cf. Hooker), *Telea polyphemus* (cf. Schulz, Zool. Annalen, IV), *Philosamia cynthia* (cf. Hooker).

(3) *Ophion bilineatus* Say, from *Samia cecropia* (cf. Hooker), *Telea polyphemus* (cf. Hooker).

(4) *Ophion bifoveolatus* Brullé. A specimen from the Gypsy Moth Laboratory, said to have emerged from a *Callosamia promethea* cocoon, but this is doubtful, as the species is a regular parasite of *Lachnosterna.*

(5) *Enicospilus purgatus* Say. From *Telea polyphemus* (cf. Felt).

The above species may be separated by the following key:

Discocubital vein angularly bent and often appendiculate.....*Ophion.*
Abdomen stout, not strongly compressed; eyes small, distant from base of mandibles.....*O. bifoveolatus.*
Abdomen usually strongly compressed; eyes large, extending nearly to base of mandibles.....*O. bilineatus.*
Discocubital vein not angularly bent; straight or curved.
Discocubital cell with one or more chitinous maculæ.....*Enicospilus.*
Discocubital cell without such maculæ.....*Eremotylus.*
Discocubital vein arcuate; wings hyaline.....*E. arctiæ.*
Discocubital vein sinuous; wings usually tinged with fulvous.....*E. macrurus.*

Other ichneumonids bred from Saturnioids are the following:

Limnerium fugitivum (Say), from *Hemileuca maia* (cf. Riley).

Campoplex quadrimaculatus Ratzeburg, from *Aglia tau* (cf. Ratzeburg).

Anomalon pyretorum Cameron (Entomologist, 1912, p. 195), from *Saturnia pyretorum;* Hongkong.

Anomalon exile Provancher ?, from *Samia gloveri* (cf. Howard).

Anomalon signatum Gravenhorst, from *Saturnia pavonia* (cf. Mocsary).

Allocamptus undulatus Gravenhorst, from *Samia cecropia* in Europe (cf. Taschenberg).

Henicospilus merdarius Gravenhorst ? from *Samia cecropia* in Europe (cf. Taschenberg).

Metopius micratorius (Fabricius), from *Saturnia pyri* (cf. Rondani).

Xanthopimpla punctator (L.), from *Cricula trifenestrata* (cf. Cotes).

Pimpla sanguinipes Cresson, from *Hemileuca oliviæ* (cf. Ainslie).

Theronia zebra (Vollenhoven), from *Cricula trifenestrata* (cf. Vollenhoven).

Cryptus extrematis Cresson. Riley's MS. notes say he bred this from *Samia cecropia* and *Callosamia promethea.* The males agreed with *C. nuncius* Say, the females with *extrematis.*

Cryptus nuncius Say. Pergande bred males from cocoons of *Samia cecropia* received from Nebraska.

Hemiteles compactus Cresson, from *Callosamia promethea,* Pennsylvania (Pergande MS.).

BRACONIDÆ.

[*Aparteles congregatus hemileucæ* Riley was bred from *Hemileuca maia* and *Automeris io* (cf. Riley). Mr. Viereck writes that this is now called *Aparteles* (*Protapanteles*) *hemileucæ.*]

TRIGONALIDAE.

[*Lycogaster pullata* Shuckard was bred in Berlin by Bischoff from pupa of *Telea polyphemus,* but it appears to be a hyperparasite of *Eremotylus macrurus* (cf. Schulz, Zool. Annalen, IV, 1911).]

CHALCIDIDÆ (sens. latiss.).

[*Perilampus maurus* Walker, from *Thyella tyrrhea* (Cramer) (cf. Walker).

Phasgonophora (?) *bauhiniæ* Girard, from *Epiphora bauhiniæ* (Guérin) (cf. Girard).

Spilochalcis mariæ (Riley), from *Telea polyphemus, Samia cecropia, Callosamia promethea,* and *Philosamia walkeri* (cf. Howard, etc.).

Chalcis ovata Say, from *Hemileuca oliviæ* (cf. Ainslie).

"*Cynips*" *bombycida* Rondani, from *Saturnia pyri* (cf. Rondani).]

DIPTERA.

TACHINIDÆ.

[*Frontina frenchii* Williston. An efficient parasite of *Samia cecropia* (Felt, 27th Report N. Y., 1912); Felt figures a *cecropia* cocoon containing 41 puparia of *F. frenchii. F. frenchii* was sent by Mrs. M. Treat to Dr. C. V. Riley, bred from *Telea polyphemus.*

Exorista cecropiæ Riley, breeding on *Samia cecropia* (cf. Pergande MS.).

Sturmia inquinata V. d. Wulp. (determined by Coquillett). Bred by Lugger from *Hemileuca maia.*

Tachina mella Walker, from *Hemileuca oliviæ* (cf. Ainslie).

Euphorocera claripennis Macquart, one from *Hemileuca oliviæ* (cf. Ainslie); bred from *Hemileuca artemis*, sent by Cockerell from Las Cruces, N. Mex. (Coquillett, Revis. Tachinidæ of America north of Mexico, 1897, p. 12).

[Martelli (Boll. Lab. Zool. Portici, 1911) has an account of *Masicera sylvatica* as a parasite of *Saturnia pavonia.*]

[Family uncertain.]

OXYTENIS Hübner.

Plate XXXVI, fig. 2 (*O. lamis.*)

Oxytenis Huebner, Verzeichniss bek. Schmett., p. 150, 1816 (?1822).—Walker, Cat. Lep. Het. Br. Mus., V, p. 1181, 1855.—Kirby, Syn. Cat. Lep. Het., p. 770, 1892.

Imago.— ♂. Front of the head square, as wide as long, being rather short and wide. Eyes moderately large. Antennæ pectinated to the tip, except the two last joints; the joints short, one pair of pectinations to a joint, the branches being spread out, ciliated, and a little longer on the outer than on the inner side. Labial palpi stout, thick, extending well beyond the front, but not so far as in *Eusyssaura;* second joint long and thick; third joint longer and more distinct than in *Eusyssaura.*

Fore wings short and broad, square at the apex, not falcate, outer edge not excavated; inner angle rounded. Hind wings short, rounded at the apex; outer edge full and rounded; inner edge nearly straight.

Venation: Of fore wing, vein II_1 as usual arises inside of the forward discal vein and of the origin of the stalk of II_2 and II_3 and ends halfway between the end of I and II_3. No traces of VIII, so well developed in *Eusyssaura.* In hind wings origins of II_1 and II_2 close together; hinder discal very oblique, passing forward and inward to meet origin of III_1. [In the revised nomenclature, for I read II, for II read III, etc.]

Markings: The species known to us bright ochreous, with an extradiscal line common to both wings; that on the fore wings beginning beyond the middle of the wing and ending on the costa just before the apex. Two remote white discal marks on the fore wings; no discal spot on the hind wings. Beneath with two remote dark discal spots on each wing.

[Kirby lists 13 species, all neotropical. The type of the genus, according to Kirby, is *O. modesta* (Stoll). Kirby's second species (*honesta* Stoll) and his ninth (*malacena* Druce) are to be removed to *Eusyssaura.*]

[Dr. H. G. Dyar (in litt., 1912) suspects that *Oxytenis* is not a Saturnian, but an Eupterotid. "The larvæ would decide, but we have none." The venation, however, is Saturnian.[1]

Eusyssaura will go with *Oxytenis,* being closely related to it.]

EUSYSSAURA Packard.

[*Eusyssaura* Packard, Journ. N. Y. Entom. Soc., XI (1903), p. 246.]
Syssaura Huebner (in part), Verzeichniss bek. Schmett., p. 150, 1816 (1822?).

Imago.—Male. Front of the head rather short and unusually broad; it is not exactly square as in *Oxytenis,* but is a little narrower in front than on the vertex. Male antennæ well pectinated to the tip; the branches being long and ciliated, and drooping so as to be folded close together as in *Platypteryx,* etc., not spread wide open as usual in the Saturniidæ; the antennal joints are short, bearing but a single pair of pectinations, but they are so close as to appear as if there were two pairs to a joint. Maxillary palpi well developed, united, quite long, much longer than usual in the group, reaching down to the base of the labial palpi. Labial palpi unusually large and thick, blunt at the end, being considerably larger and thicker than in

[1] [All the following genera, according to Dr. Dyar, have Saturnian venation, and yet may be Eupterotid; *Lonomia* Walker, *Oxytenis* Hübner *Asthenidia* Westwood, *Therinia* Hübner, *Draconipteris* Hübner, and *Teratopteris* Hübner. For the venation of the last, see Plate XLI, fig. 4.]

Oxytenis (*O. lamis*); the basal joint short, the second very long and large, thick, extending very far (for this family) beyond the front; third joint small, depressed, not so distinct as in *O. lamis*. Eyes moderately large.

Fore wings of almost exactly the shape of those of *Platypteryx*, the apex being much more produced than in *Oxytenis*, and square at the tip; the costa is much curved toward the apex; outer edge deeply excavated toward the apex; inner angle rectangular.

Venation: Very different from that of *Oxytenis* since II [III, in revised nomenclature] is very short, arising not within the origin of the discal vein but far out near end of I [II]. II_2 wanting. In both wings the forward discal vein is much curved inward, the hinder vein oblique and not curved. Hind wings full, apex not so round as in *Oxytenis*, more angular; outer edge regularly convex and rounded; inner edge nearly straight and long; the end of the abdomen reaches a little beyond the middle of the hind wings. Venation remarkable for the presence of a long vestige of vein VIII.

The type of this genus is *Attacus honesta* Stoll. Druce's *Oxytenis malacena* from Panama is a member of this genus, the species of which range from Nicaragua to the Amazons.

EUSYSSAURA HONESTA (Stoll).

Plate XXXVI, fig. 3.

Attacus honesta STOLL, Pap. Exot., IV, t. 302, C. D. (1781?).
Oxytenis honesta WALKER, Cat. Lep. Het. Br. Mus., V, p. 1182, 2, 1855.
Oxytenis honesta KIRBY, Syn. Cat. Lep. Het., p. 770, 1892.
[Dr. Packard adds in pencil, ? *malacena* Druce.]

One ♂. Body and wings uniformly ochreous brown, the color of a dead leaf. Wings strikingly similar in shape, color, and markings to *Platypteryx*. Fore wings with no distinct basal line. A minute black discal dot with a few white scales on the inside or in front, forming a very faint thin broken indistinct line, ending in a white dot on vein II. About halfway between the discal dot and the outer edge of the wing is a reddish brown line beginning on the middle of the inner edge, and ending on the apex of the wing, which is dark brown, frosted over with fine white scales. An irregular zigzag line begins beyond the extradiscal, but nearer to it on the inner edge of the wing than to the inner angle; it then approaches the extradiscal line, and runs nearly parallel with it to the apex. Beyond the extradiscal line of both pairs of wings, the wing is darker than within.

Hind wings with the extradiscal line passing close to the discal spot. Beyond it is a zigzag line; the space between it and the extradiscal filled in with darker brown than on the rest of the wing.

Beneath decidedly ochreous, except on the outer half of the hind wings, i. e., the region beyond the extradiscal line.

Expanse of fore wings, 62 mm.
Length of fore wing, 31 mm.
Breadth across the discal [spot], 15 mm.
Length of hind wing, 22 mm.
Breadth of hind wing, 18 mm.

This moth strikingly recalls *Platypteryx*, though much larger, and like that moth it is probably protected from observation by appearing like a piece of sere and brown leaf. Were it not for the difference in size, the zealous advocates of natural selection as invoked to explain such resemblances might regard this as brought about by selection. But as in many other cases so considered, the striking similarity in shape and markings were more probably brought about by similar environmental causes, without reference to the biological *milieu*.

Geographical distribution.—Nicaragua to Amazons.

DRACONIPTERIS Hübner.

Plate XLI, fig. 4.

♂. General characters: Head prominent, front rather narrow, not full and convex; eyes larger than usual; the front no wider than one of the eyes, as in *Eusyssaura honesta*. Antennæ well pectinated to the tips, joints short, numerous, but a single pair of pectinations to a joint; pectinations moderately ciliated, cilia very fine.

Palpi very large, ascending, reaching quite far beyond the front, as in *E. honesta*, broad and rounded at end; second joint long, third short and small, fairly distinct though depressed. Maxillæ distinct, rolled up, united at base.

Fore wing with costa much arched on outer half, apex much produced; outer edge differs from *E. honesta* in being deeply scalloped, and so unevenly as to be ragged and irregular like a frayed leaf edge; in middle of wing a large prominent jagged tooth, behind which the edge is deeply excavated, and on this part of the edge three uneven teeth.

Fig. 34. Apex of the anterior wing of Saturniid moth. Miocene shales of Florissant.

Hind wing broad, outer edge with two teeth behind the angular apex, the outer edge not quite so full and rounded as in *E. honesta*. Abdomen scarcely reaching beyond the middle of inner edge of wing.

Markings as in *E. honesta*, general color like that of a dry leaf, but with three dark spots near inner angle.

Two forms [examined]. *D. angulata* (Cramer) is paler and smaller (expanse 60 mm.), but markings above and beneath and outer edge of fore wings are identical with those of *D. mirabilis* (Stoll). (Expanse 74 mm.) They are probably seasonal forms.

Length of fore wing, ♂ *angulata*, 29 mm.; *mirabilis*, 37 mm.
Width of fore wing, ♂ *angulata*, 17 mm.; *mirabilis*, 21 mm.
Length of hind wing, ♂ *angulata*, 23 mm.; *mirabilis*, 28 mm.
Width of hind wing, ♂ *angulata*, 17 mm.; *mirabilis*, 21 mm.

D. angulata from the Amazons; *D. mirabilis*, Peru (Staudinger, Dyar collection); Demerara (British Museum, Walker).

[*D. angulata* is the type of *Teratopteris* Hübner.]

[FOSSIL SATURNIIDÆ.]

[No fossil Saturniidæ have been described, but we have obtained in the Miocene shales at Florissant, Colo., what appears to be the apex of the anterior wing of a large saturniid; the venation corresponding very well, so far as preserved, with that of a similar area in the wing of such a species as *Attacus dohertyi*. The fragment, which is about 33 mm. long, is figured herewith. It may be known as *Attacus? fossilis*, new species.]

BRAHMÆIDÆ.

BRAHMAEA JAPONICA Butler.

Plate XXXIV.

A number of pupæ from Japan of this interesting monogeneric type were obtained by purchase, and Mr. Joutel kindly mated the moths, thus obtaining a supply of the eggs, from which the larvæ were reared by him and myself in all stages. The eggs were laid in April, and the larvæ hatched April 27, while I received tham alive (four examples) April 28. They fed on the privet and lilac, and throve well in Providence on the latter plant.

Eggs.—Rather high, somewhat conical, with a broad, flattened base and the apex a little depressed. It thus differs from the somewhat flattened eggs of Ceratocampidæ, and from the ovo-cylindrical eggs of the Saturniidæ; apparently presenting striking family differences. The shell is seen under a strong lens to be finely pitted.

Larva.—Stage I: Length 9–12 mm. Width of head 1⅓ mm. Head small, no wider than the body, smooth, jet-black, polished and shining; with scattered long hairs. Body elongated, rather slender compared with Ceratocampid larvæ of this stage; the body does not taper behind. On the trunk segments (thoracic and abdominal) are six rows of small black tubercles scarcely higher than they are thick, and giving rise to from seven to eight black hairs about as long as one-third the diameter of the body. The tubercles on the first thoracic segment are no larger than those on the abdominal segments; on this segment they are situated on a black cervical shield, forming a transverse black band, somewhat contracted in the middle.

Four large, long, thoracic dorsal horns, all of equal length, a pair on the second, and another pair on the third thoracic segment. They are each about one-fifth to one-quarter as long as the body, all of the same shape and thickness, scarcely tapering to the end, which is blunt, black-brownish at the end, flexible, not stiff, rigid and chitinous, and furnished with numerous long fine hairs, which are of nearly equal length; those at the end almost forming a pencil or brush; each hair very finely spinulated.

The horns themselves are of uniform width, not varying in diameter, and with a twisted appearance, as in stages II to IV.

A large erect caudal horn on the eighth abdominal segment, a little stouter and not quite so long as the thoracic ones, but like them thin-skinned, hairy, not tuberculated or twisted as in the penultimate stage.

The dorsal tubercles on the ninth abdominal segments are of the same size and shape as those of segments 1–7.

Suranal plate small, triangular, black.

On each side of the base of the plate are two high erect horns, like those on the second and third thoracic segments, but about one-half as long, though of the same shape, thin-skinned, flexible, and with similar black hairs.

The spiracles are black and inconspicuous.

Coloration: The body is dull black, except the thoracic segments and end of the body. The thoracic segments are livid yellow, with black patches on the sides; in some individuals the first thoracic segment is black, with a small yellow spot above. There are two dark roundish dorsal spots on the hinder edge of the second and third thoracic segments. Along the body is a faint yellowish spot (sometimes reddish or rusty yellow) on each side above the legs. The eighth and ninth abdominal segments are pale ochreous yellow; the base of the caudal horn and suranal horns black.

The distinctive colorational feature is the pale steel-blue ring or band passing around the body in the middle of each segment and the dark sutures, making about 13 bluish ring in all. Of these dark bands, that on the first abdominal segment is the widest, the corresponding ones behind, known by inclosing the spiracles, being a little narrower. The narrow bands are on the sutures between the segments.

The thoracic and abdominal legs are dark, except the front of the anal legs, which is yellowish.

In this stage the caterpillar is a very conspicuously marked and colored one, with a formidable armature in appearance, but the high slender horns are not stiff and spiny, only hairy. It remains to be seen whether this caterpillar is inedible by reason of some poisonous or nauseous secretion.

The larvæ at Providence molted May 8 or 9, having been in stage I about 10 to 11 days.

Stage II: Length 12–15 mm. Width of head 1⅔ mm. It does not now much differ in the general proportions and length of the horns from the previous stage, though these are now *hairless and twisted* and somewhat longer, *but the body is now of a porcelain white, and the bands, now brown-black, are broken up into black spots.* All the horns are now longer, smooth, without the hairs of stage I, while they appear as if slightly twisted, being enlarged at irregular intervals and there giving off a minute seta. The head is still black; there are two white longitudinal bands, quite irregular in length and width, on each side of the head. The antennæ are black

and the region around their base is black. The clypeus-posterior is black with two yellow spots in the center. The labrum and the region on each side is black. The head is fully as wide as the body.

First thoracic segment straw-yellow, with four dorsal black spots whitish in the middle above; two black spots on each side. On the second thoracic segment are two larger black spots, and two larger ones on the third segment. On each of abdominal segments 1–7 are five black dorsal spots, the black bands now being divided into spots; on segments 8 and 9 two dorsal black spots, and the front edge is black. The eighth segment is orange-reddish, becoming deeper on the sides. The sides of the abdominal segments below the spiracles are orange-ochre, on the thoracic segments the corresponding region is yellowish. On the ninth segment are two dorsal black spots, and on the front edge five black spots.

Suranal plate pale straw-yellow, black at the end; there are two small black dots on the front edge. Each abdominal segment with eight black spots on each side of the median spot, making seventeen spots in all.

Anal legs white, with five black unequal vertical stripes, the edge of each stripe black all around. Midabdominal legs dark brown, with a black ring at base, and another just above the planta.

The skin is provided with very fine short scattered dark hairs, those on the midabdominal legs much longer than those on the body.

Stage III: Length 17–27 mm. Width of head $2\frac{2}{5}$ mm. The head is mostly black, but with white lines so disposed as to break it up into five irregular black lines or spots on a side; the two on the vertex, one on each side of the median line or suture of the head, above the apex of the clypeus, each forming a short curved band; the two lowest black spots down on the side near the ocelli are triangular. Clypeus black, the head being white on each side next to it. The anterior division of the clypeus is white, as also the base of the antennæ. Toward the end of the stage the white lines of the head become wider, so that the black areas are somewhat reduced in size.

The body is pearly white, with a larger portion white, the black spots being smaller and more numerous than in stage II.

Prothoracic segment with only two dorsal spots instead of the four black spots of stage II, the two dorsal ones conspicuous and elongated, diverging from each other.

The second and third thoracic and eighth abdominal segments, and the suranal plate at the base of the two horns, are now distinctly enlarged or swollen, remaining so through stage IV, when they are more conspicuously inflated, much as in *Arsenura xanthopus* as figured by Peters. All the horns are much as in stage II, being swollen where a seta is given off, and more or less crumpled, kinky, or twisted. Length of thoracic horns 10 mm., being fully one-half as long as the entire body; length of caudal horn 6 mm.; of the two suranal horns $3\frac{1}{2}$ mm.

The black patches more numerous and smaller; those on the tergum are now broken up into separate spots. There are now on each abdominal segment 1–7 three rows of lateral black spots, and a conical one just behind the middle of each segment, or seventeen spots on each segment. Of these three rows the lowest one is the spiracular one, the black spiracle being situated in the center of the middle one of the three spots forming the line.

On the eighth abdominal segment are four black spots on each side, one inclosing the spiracle, and a median one behind the caudal horn. On the ninth segment are six black spots on each side and one in the middle, or thirteen in all. On the front edge of the second and third thoracic segments are two black spots.

The suranal plate is smooth, white, unarmed, no setæ, only the two black horns; the end of the plate is black.

There is a group of about a dozen minute short fine setæ on each side of the tergum of abdominal segments 1–7, marking the probable site of tubercles in the ancestors of the group.

Above each midabdominal leg is a black spot, while the legs themselves are blackish at base and near the planta, the basal spot inclosing a white patch; the hinder part of the leg is

marked with obscure greenish yellow. Anal legs black, inclosing three unequal vertical white stripes. Thoracic legs black.

Under side of the body livid pale, with a wide black lateral and a black middle line.

This description will almost equally well apply to stage IV, the two stages being much alike in coloration and armature.

Stage IV: Described May 16. The length of this stage was 4–5 days. Length 42 mm.; width of head $2\frac{3}{5}$ mm.

The body is now still long and slender, and of the same width throughout. On the dorsal side it is of a shining bluish white with a yellow tinge. Four black dorsal dots on the prothoracic segment arranged in a square, and two larger black spots in front of each pair of horns; on each abdominal segment three or four minute dorsal black dots. On the side of each segment are seven to eight black spots which are arranged in two rows, one (containing the larger number of spots) straight, including the black spiracles, the other broken up into an oblique row of about three spots on one side of each segment and passing up the front edge of each segment. Farther down on each side is a large black spot over the base of each midabdominal leg.

The head is striped with black, with five irregular unequal short black lines on each side, while there are two black patches next to the antennæ.

The horns are now long and slender, a little tapering, but blunt at the tips; those of the third a little longer than those of the second thoracic segment, and between a third and a half as long as the body; the caudal horn is about one-fourth as long as the body, while those of the pair on the ninth segment are slightly more than half as long as the caudal one. The horns are all more decidedly curled or twisted than before, and the fine spinules more developed.

On abdominal segments 1–7, in the place where tubercles should be, is a group of 10 minute very short somewhat scattered setæ, indicating that they may be the vestigial remains of a tubercle; there are two similar groups on the ninth abdominal segment, of 6 similar fine setæ.

End of the suranal plate black; the surface smooth, not finely tuberculated.

Under side of the body pale greenish, with a median interrupted black line, and on each side higher up is a heavier black stripe, more or less undulating, and on the abdominal leg-bearing segments they are slightly oblique, ascending toward and reaching the front edge of the segment.

It moulted about May 20–21.

It is noteworthy that on the front edge of the prothoracic segment there are six vestigial tubercles, indicating the descent of this genus from ancestors with six tubercles. The two dorsal ones form a very small, nearly obsolete, slightly marked transverse rough area; but in front of the spiracle is a large low rough slightly raised round area with very short fine setæ; below, above the base of the legs, is a more prominent brown one. The corresponding ones on the second and third thoracic segments are still less marked, being only faintly visible.

Stage V: Length 63–76 mm., width of head $6\frac{3}{4}$ mm. *The body is now without horns, and is smooth*, cylindrical, a little flattened and naked, with *minute tubercles in place of the horns.* The head is flattened in front, a little angular on the sides; the surface rough and straw-yellow, with five black lines of uneven width and length, a black band ending on the eye area, there being in all eight lines and spots. Clypeus whitish, with two semicircular cross bands. There is a whitish patch in the middle of the vertex, and a whitish area on the sides.

The body is less cylindrical than in the previous stages, being a little flattened, and has the general appearance of a hornless Sphingid caterpillar.

The ground color is a delicate greenish pearly or porcelain white, bathed on each side of each segment and along the hinder edge of each segment with pale straw-yellow. On the smooth prothoracic segment are four black dorsal spots, two round ones in front, and two large ones behind; a lateral long stripe behind the spiracle. There are no marked dorsal spots; those of the oblique lines are minute, and the black marks are chiefly confined to the spiracular series.

On the second thoracic segment in place of the two horns are two low, rather large fleshy tubercles which are a little larger but not so high and prominent as those on the third thoracic segment, though the two latter are less broad at the base.

On the eighth abdominal segment, in place of the atrophied caudal horn, is a low inconspicuous tubercle, at the apex of which is an indistinctly double (?) little wart.

On the ninth segment are two slightly full, low swellings with seven or eight short minute setæ, indicating that they were the site in the ancestral form of this genus of two horns, warts, or tubercles.

Suranal plate black at the end, which is somewhat rugose. Surface of plate whitish; on the sides and behind pale straw-yellow. On the site of the two horns of the previous stages are two rounded conical black tubercles which are more solid and chitinous than those in front, and more like vestigial horns.

On the side of the segments is a black spiracular very irregular and much broken line, the spiracles being black; above this line on each segment are three black spots forming an oblique line, the most anterior spot (forming the upper end of the line) being near the front edge of each segment. On each abdominal segment except the tenth (suranal plate) are two black dots situated near the front edge of the segment. Below the spiracular line the body is deeper, almost orange-yellow.

Thoracic legs pale, with black rings and spots, mid-abdominal legs dull livid green with a black narrow wing at the base, and another one above the planta.

Underside of the body deep salmon red, with an irregular black line on each side, and on this line and in toward the middle of each segment are small setiferous black tubercles, white at the apex, and giving rise to a very short seta. Anal legs fairly large, and sphingiform.

Habits.—The larva is active in its movements; when rudely poked or handled it will suddenly jerk its head as if offended, and eructate a portion of its partially digested food. It assumes a decided sphinx-like attitude.

Its larval life extends over about five or six weeks or 35 to 45 days. It molts four times; the first stage occupies about 9 or 10 days, the second about 6 or 7; the third and fourth stages about 4 or 5 days; and it remains in the last stage about a week (7 to 9 days); the eggs hatched May 27, and one larva pupated June 11–12.

Acceleration of characters after stage I.—It is to be observed that the armature and coloration are the same in stages II–IV. It is a rule in Ceratocampidæ and Saturniidæ that the characters of the last stage are not assumed until after the second molt, but here those of the penultimate stage are assumed after the first molt, and in stage IV there is no sign of the atrophy of horns, and of the color differences of stage V.

The larva malodorous and its colors warning.—Larvae of the last stage on being handled were observed to emit a peculiar strong odor, a little like musk, and they did so on several occasions when disturbed or handled.

This fact, that the larva throws off a bad smelling or repugnatorial odor, and that it also vomits its food on being disturbed, should be coupled with the fact that it is a conspicuously marked caterpillar in all stages of existence, both when ornamented with long horns at each end of the body, and when after its last molt it is smooth-bodied, without even a caudal horn. The caudal horn of the earlier stages shows no sign of a bituberculous origin.

Analogies to Ceratocampidæ and to Sphingidæ.—On a first glance at the moth one would naturally suppose that it had no relationship to either of these two families; the shape and peculiar markings of the wings are so unlike any of them, but a knowledge of the early larval stages, and of the pupa, with its subterranean habits, led us to examine its structures and affinities, and at first we supposed that this monotypical group had descended from the Ceratocampidæ and forms a side branch.

The larva in its third and fourth stages closely resembles that of *Arsenura* in the same stages, while the larvæ of the two genera are similar in the final stage V, but these resemblances are only analogies, not true affinities.

A pair of locomotive tubercles or claspers on the second abdominal segment.—Mr. Joutel has called my attention to a pair of soft tubercles or claspers on the second abdominal segment "which is thrust out and seems to be used in walking as though it were a clasper."

On examination of alcoholic specimens of stages IV and V, I find on the second abdominal segment a pair of small tubercles situated in a place exactly corresponding to that of the mid-abdominal legs. Each one is about one-eighth as large as a mid-abdominal leg; about as high as broad at the base, rounded, soft, and giving rise to six or seven black setæ of uneven length, but with no definite arrangement; the tubercles are situated in the path of the latero-ventral black line. On the first abdominal segment is a minute soft low flattened tubercle situated in the same relative position, but wanting in stage IV. Are these processes to be compared with the supernumerary legs of *Megalopyge?* Are they the survivals of primitive abdominal legs?

Pupa.—In shape and size closely similar to that of *Eacles imperialis.* It agrees with the head characters, i. e., the eyes, antennæ, legs, and wings, differing only in lacking the short stout spines which beset the head and thorax of *Eacles,* the body being smoother and somewhat polished; the hinder edge of the free segments (abdominal) is smooth, not spinose, as in *Eacles.* The chief difference consists in the shape of the cremaster, which instead of being narrow, slender, and flattened, is very stout, somewhat conical, much contracted at its base, and with coarse pits, some of which are confluent, forming deep smooth furrows or channels. The cremaster ends in two smooth cylindrical spines. Length 40 mm.; thickness of body 13 mm.

Variation in the terminal spines of the cremaster.—In one example there is but a single median spine at the end of the cremaster, with no vestige of its mate, the spine being central.

When one comes to the moth one would hesitate at classifying *Brahmæa* with the Ceratocampidæ or the Saturnians; its general appearance forbids this. The wings of the Asiatic species are not falcate, and the mode of coloration of the Brahmæidæ is marked by the extraordinary development of undulating lines or bars, which remind one of the geometrid *Scotosia undulata.* Evidently its style of protective coloration, the green, black, and gray tints and lines, enable it while resting on the bark of a lichen-covered tree to elude observation.

The venation (♂ and ♀), however, while presenting some important Ceratocampid characters, indicates that *Brahmæa* should be assigned to an independent family. The first subcostal vein (III_1) is very short, arising very near the apex of the wing, far beyond the origin of the third subcostal (III_3). The second median (IV_2) forms an independent vein, as in Ceratocampidæ. The discal cell is very small, and the discocellular veins form a reentering angle. In the hind wing the discal cell is remarkably short, not much longer than wide. The subcostal vein (II), instead of being remote from the subcostal as in all Ceratocampidæ, is very close to the subcostal, nearly touching it a little beyond the discocellulars.

The ♂ genital armature is of the Ceratocampid type; the suranal plate being large, broad, slightly bilobed at the end, while the claspers are very broad, rounded at the end, and not mucronate.

While *B. certhia* is regarded as the type of the genus, it, or any of the Asiatic species, scarcely appears to be the stem form. For this we shall have to turn to the West African *B. lucina,* in which the fore wings are produced toward the apex which is somewhat falcate, and the markings suggest the South American *Arsenura;* the apical oval dark spots recall those of that genus.

Although there are certain striking superficial resemblances in the larva and pupa to the Ceratocampidæ, the antennæ are, however, as in *Bombyx mori* and Lasiocampidæ, there being but a single pair of pectinatons to a joint. The larva before the first molt is as in *B. mori* and *Endromis,* the flattened tubercles giving rise to several (6 to 10) setæ. The head is as in *B. mori,* the epicranium short and broad, the clypeus sunken; the suranal plate as in *B. mori* and Lasiocampidæ. The Brahmæidæ should be associated in a group for which we propose the name *Symbombycina,* with the families Bombycidæ, Endromidæ, Lasiocampidæ, Liparidæ, and Eupterotidæ.

We have, from our studies, been led to infer that the original home of the Brahmæidæ may have been in Africa south of the Sahara region, and that the Asiatic and southeastern species are derived from African forms. They are certainly rather more modified, the wings shorter and broader, and the markings more specialized than in the African *B. lucina.*

PLATES.

PLATE I.

PHILOSAMIA CYNTHIA [WALKERI].

Larval stages. J. Bridgham del.

FIG. 1.—Before first molt. June 12, 1890. In the dorsal views of the first three stages, the lower lateral rows of tubercles are not shown, on account of confusion. They incline downward, and have seven spines, while the upper two rows have five spines each.

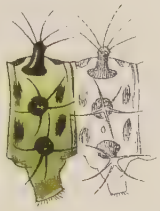
FIG. 2.—Second stage, June 15. *A*, section of sixth segment; the tubercles are drawn a little too long in this section,

FIG. 3.—Third stage, June 17. *A*, twelfth segment, lateral view. *B*, twelfth segment from behind. *C*, tubercle.

FIG. 4.—Fourth stage, June 24. *A*, dorsal tubercle. *B*, spiracle. *C*, dorsal view of sixth segment. *D*, lateral tubercle. All the spines or hairs are transparent amber color.

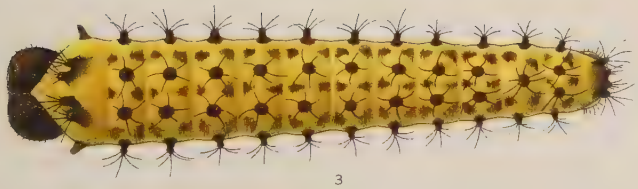
1.

2.



1a.

2a



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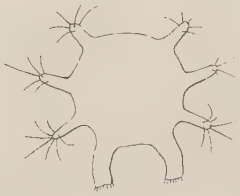
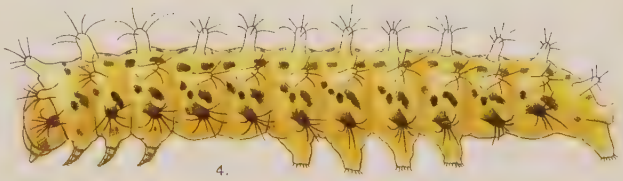


2A.

3B

3A.

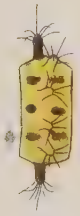
3C.



4.

4A.

4B.



4C.

4D.

Bridgham, del.

LARVAL STAGES OF PHILOSAMIA CYNTHIA.

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PLATE II.

PHILOSAMIA CYNTHIA [WALKERI].

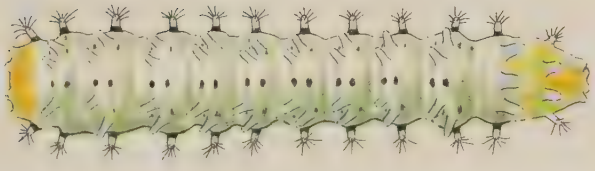
Larval stages. J. Bridgham del.

FIG. 1.—Fifth stage, June 27.

FIG. 2.—Sixth (last) stage, July 8. Food wild cherry. The five spines on the tubercles are rudimentary.

1.

1a.



2

2a.

Bridgham, del.

LARVA OF PHILOSAMIA CYNTHIA.

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PLATE III.

PHILOSAMIA CYNTHIA [WALKERI].

Photographs of larvæ.

LARVÆ OF PHILOSAMIA.

PLATE IV.

ROTHSCHILDIA ORIZABA.

Larval stages. Joutel del.

FIG. 1.—First stage, just hatched.
FIG. 2.—Second stage.
FIG. 3.—Third stage. "Blue-green between segments."

ROTHSCHILDIA JORULLA (CINCTUS).

Larval stages. Joutel del.

FIG. 4.—First stage.
FIG. 5.—Second stage. The third stage is like second.

1

1a.

2

3.

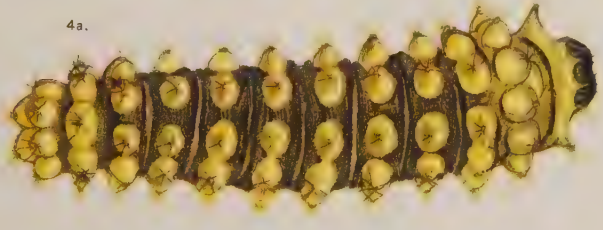
2a.

3a.

5.

4.

5a.



4a.

L. H. Joutel, del.

LARVÆ OF ROTHSCHILDIA.

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PLATE V.

ROTHSCHILDIA JORULLA.

FIG. 1.—Fourth stage.

FIG. 2.—Fifth stage.

SAMIA CECROPIA × COLUMBIA.

FIG. 3.—Hybrid, *Samia cecropia* ♂ ×*columbia*, ♀. Fourth stage larva. Fed on wild cherry. Joutel del.

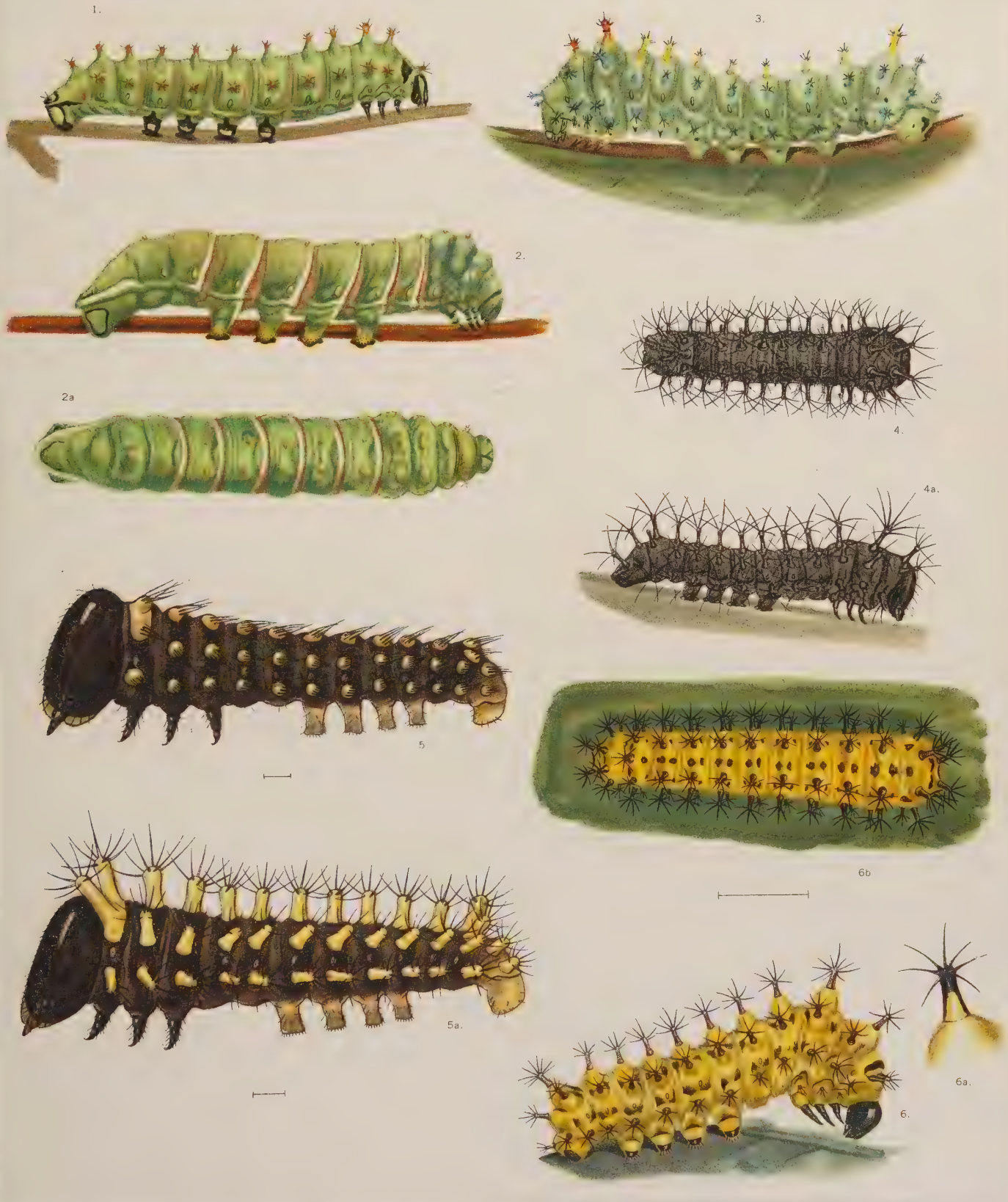
SAMIA CECROPIA.

Larval stages.

FIG. 4.—First stage, Joutel del. "*Cecropia* can be readily separated from *gloveri* in first stage by the black spines; *gloveri* spines light."

FIG. 5.—First stage, with yellow tubercles. Bridgham del. 5, just hatched; 5*a*, half hour after hatching. Hairs of 5*a* a little too short (Packard).

FIG. 6.—Second stage, Joutel del. 6*a*, front view of dorsal tubercle. Drawn from a very orange larva; they vary to lemon yellow. "*Cecropia* in stage 2 can be easily separated from *gloveri* by the yellow on the anterior part of dorsal tubercle (*gloveri* entirely black); less variety in larva stage 2 of *cecropia* than *gloveri*."



Joutel and Bridgham, del.

LARVÆ OF ROTHSCHILDIA AND SAMIA.

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PLATE VI.

FIG. 1.—*Rothschildia orizaba*, male. Miss Soule photograph.
FIG. 2.—*Rothschildia orizaba*, female. Miss Soule photograph.

ROTHSCHILDIA ORIZABA.

PLATE VII.

SAMIA CECROPIA.

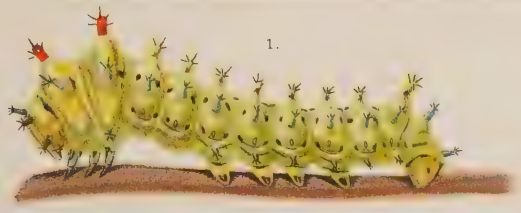
Larval stages.

FIG. 1.—Third stage. Joutel del. Two color varieties. Some larvæ in this stage are yellow, some bright orange with all sorts of intermediates, but most are green.

FIG. 2.—Fourth stage. Joutel del. "No variation among 200 larvæ."

FIG. 3.—Fifth (last) stage. Joutel del. "Most larvæ have the yellow tubercles with two black spines; sometimes three spines are present (fig. 3*a*) and occasionally one spine; the three forms often on same larva, and none entirely 1-spined or 3-spined."

FIG. 4.—Fourth stage; yellowish-green form. Bridgham del. "The amount of black spot on the pillar of the tubercle is variable." *A*, face; *B*, tubercle of eleventh segment; *C*, tubercle of second and third segment; *D*, tubercle of dorsum; *E*, tubercle of side row; *F*, tubercle of twelfth segment.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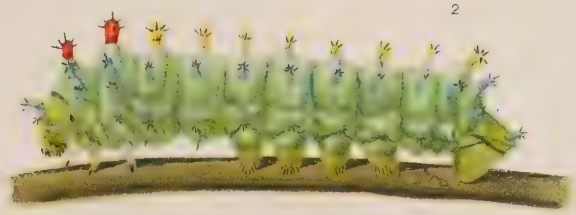
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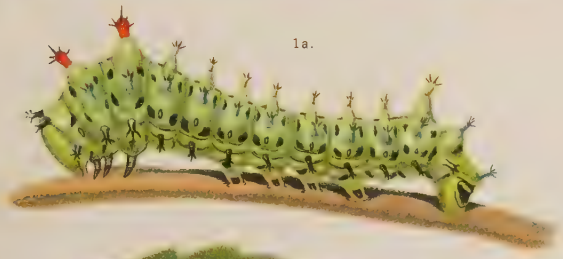
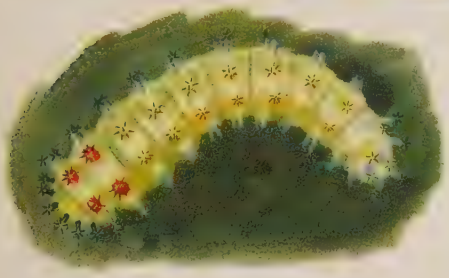
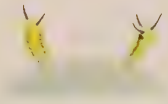

1a.

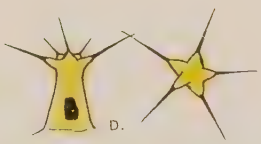
2a.


1b.

3.


3a.

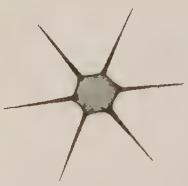
E.

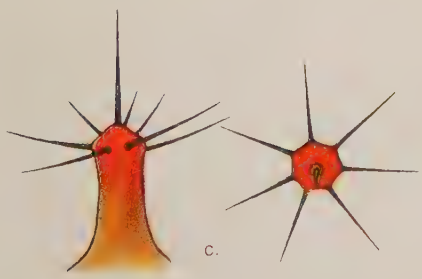

D.

E.

A.

4


F.


C.

Joutel and Bridgham, del.

LARVÆ OF SAMIA CECROPIA.

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PLATE VIII.

SAMIA CECROPIA.

FIG. 1.—Last stage of larva, natural size; form with red thoracic tubercles; August 18, food white birch. Bridgham del.

SAMIA GLOVERI.

Larval stages. Joutel del.

FIG. 2.—First stage. The hairs are light (jet black in *cecropia*).

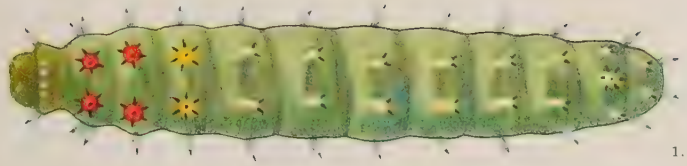
FIG. 3.—Second stage. From two different larvæ. "The color ranges through various combinations of yellow and yellowish green and black; tubercles always bright orange yellow, only the spaces between varying as to amount of black, yellow, and green."

FIG. 4.—Third stage. Probably typical variety, but intergrades with the others. "The red horns turn black from the posterior end of larva; some have only a little red on horns of second segment." (Joutel.) Variety A of Joutel.

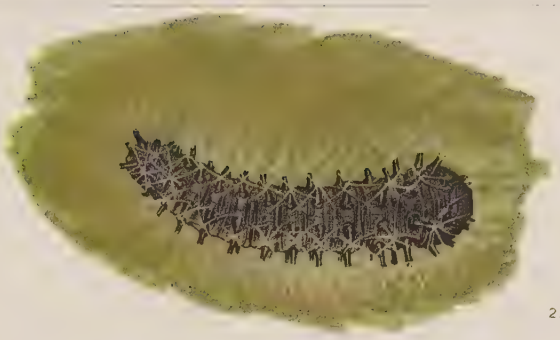
FIG. 5 —Third stage. Variety B of Joutel. "Some larvæ are like B (all black horns), but have yellow body like A." (Joutel.)

FIG. 6.—Third stage. Variety C of Joutel.

FIG. 7.—Third stage. Variety D. "A very dark specimen was about same color in beginning of stage, but with more black on each segment back of the tubercles." (Joutel.)



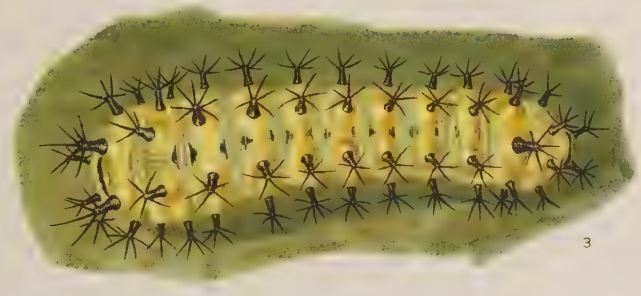
1.



2.

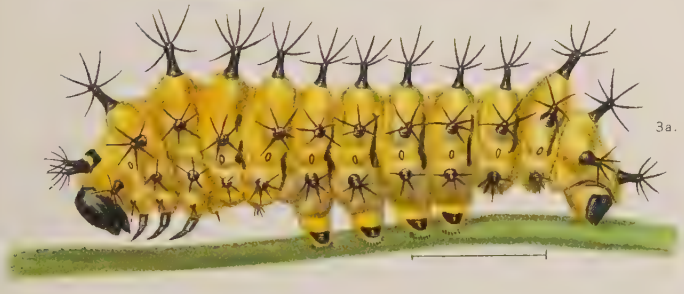
1a.

2a.

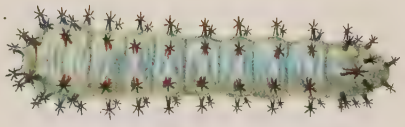


3

4.



3a.



4a.

6.

7.

5.

Bridgham and Joutel, del.

LARVÆ OF SAMIA CECROPIA AND S. GLOVERI.

A HOEN & CO. BALTIMORE, MD.

83570°—14——20

PLATE IX.

SAMIA GLOVERI.

Larval stages. Joutel del.

FIG. 1.—Fourth stage. "In some the blue color on the dorsum runs down to the yellow prolegs; sometimes the black ring around the subdorsal and side tubercles is wholly or partly lacking; sometimes the larva has six stages, then the fourth is always without the black rings and the fifth has them; in some the horns on second, third, and fourth segments are orange and the one on joint 11 yellow." (Joutel.)

FIG. 2.—Last stage.

SAMIA COLUMBIA.

Larval stages. Joutel del.

FIG. 3.—First stage. End of first stage.

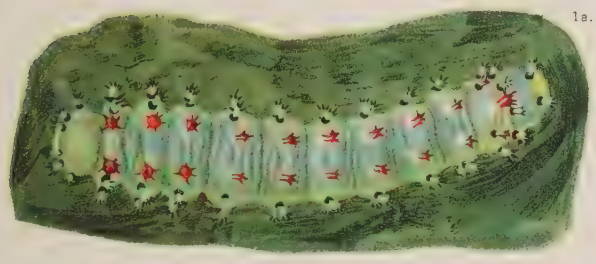
FIG. 4.—Second stage. Preparing to molt.

FIG. 5.—Third stage. About to molt. 5a is enlarged one-half.

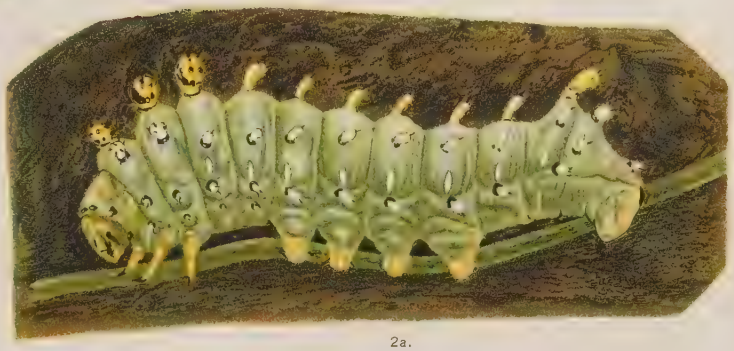
FIG. 6.—Fourth stage.

1.

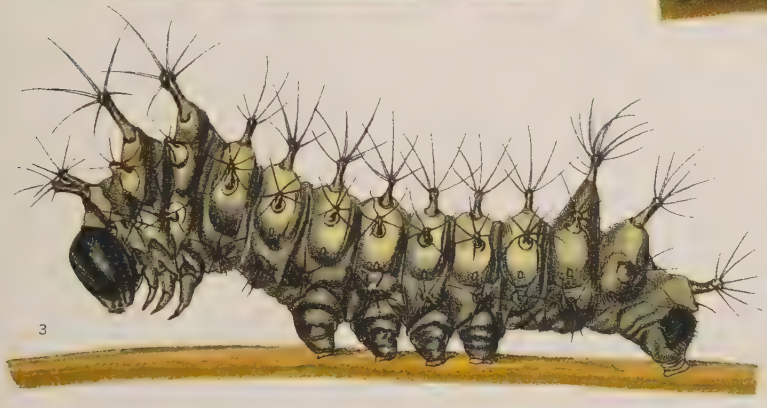
2.



1a.



2a.

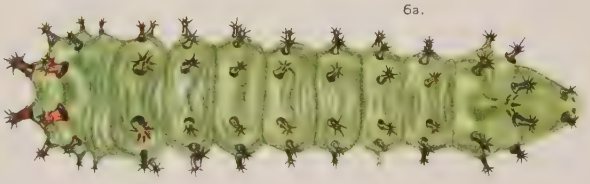


3

5.

5a.

4.



6a.

6.

L. H. Joutel, del.

LARVÆ OF SAMIA GLOVERI AND S. COLUMBIA.

A.HOEN & CO. BALTIMORE, MD

PLATE X.

SAMIA COLUMBIA.

FIG. 1.—Larva, last molt. Joutel del.

SAMIA RUBRA (CEANOTHI; CALIFORNICA).

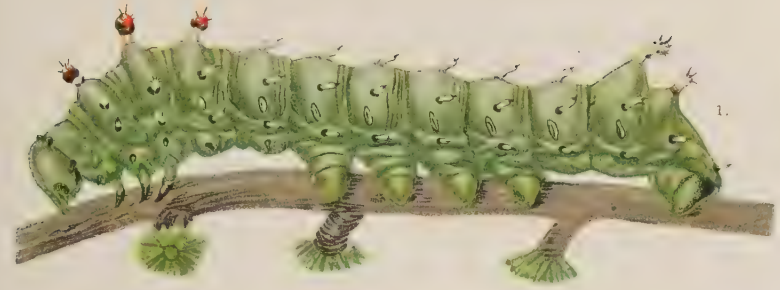
Larval stages. Joutel del.

FIG. 2.—First stage.

FIG. 3.—Second stage. At end of stage.

FIG. 4.—Third stage. "Some larvæ are quite yellow instead of green, with dorsal tubercles of a deeper yellow; some are green like figure but have the dorsal tubercles bright red; some are without any black except spines at top of tubercles." (Joutel's notes.)

FIG. 5.—Fourth stage. "Some of the larvæ have the black circle at base of blue tubercles wanting." (Joutel.)



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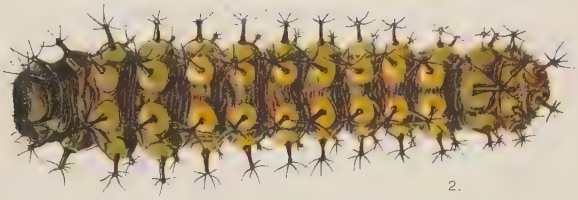

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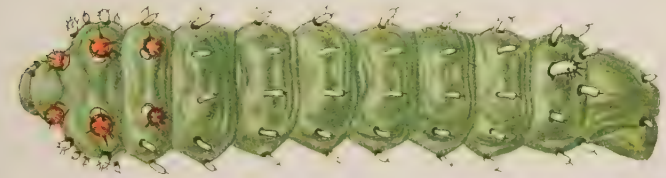
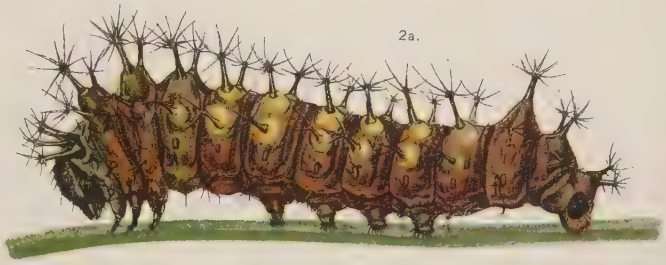


1a.

2a.



5.

3.

5a.

3a.

4.

L. H. Joutel, del.

LARVÆ OF SAMIA COLUMBIA AND S. RUBRA.

A. HOEN & CO. BALTIMORE, MD.

PLATE XI.

SAMIA RUBRA [CEANOTHI; CALIFORNICA].

FIG. 1.—Larva, fifth stage. Joutel del.

CALLOSAMIA CALLETA [EUPACKARDIA CALLETA].

Larval stages. Joutel del.

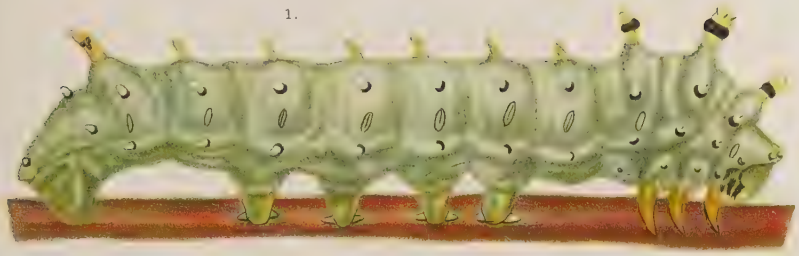
FIG. 2.—First stage, two days old.

FIG. 3.—Second stage.

FIG. 4.—Fourth stage. "In this stage most of the larvæ have the tubercles entirely black; some few, however, have pale blue at tips of dorsal ones on segments 2, 3, 4, 5, 6, 11, and 12; sometimes fewer segments have blue." (Joutel's notes.)

FIG. 5.—Fifth stage. "Some larvæ have less black, and a few have none."

1.



1a.

4.

4a.

3.

5.

3a.

2.

2a.

PLATE XII.

CALLOSAMIA PROMETHEA.

Larval stages.

FIG. 1.—First stage. Bridgham del. Food, sassafras and wild cherry; July 15.

FIG. 2.—Second stage. Bridgham del. Food, sassafras and wild cherry; July 23, 1888. Spot on side of last abdominal leg should be crescentic. A, dorsal view; B, side view; C, dorsal tubercle, side view; D, dorsal tubercle, from above; E, front view of head.

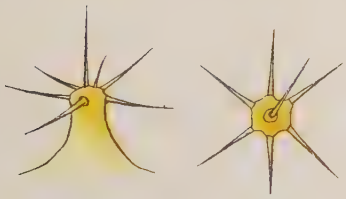
FIG. 3.—Third stage. Joutel del. Two different larvæ. "*Promethea* has only four stages: *cecropia*, *polyphemus*, *luna*, usually five stages, sometimes six stages; *gloveri* five and six stages; *californica* five stages." (Note by Packard on back of Joutel's drawing.)

1c.

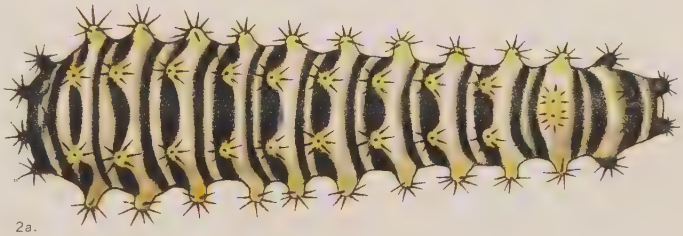
1a.

1d 1e.

1b.

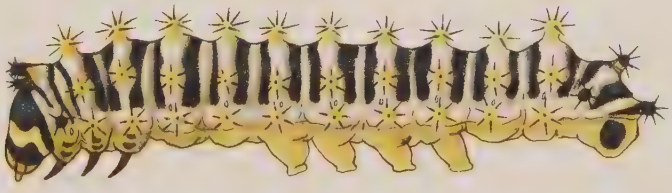


2c. 2d.



2a.

2e.



2b.

3.

3a.

Bridgham and Joutel, del.

LARVÆ OF CALLOSAMIA PROMETHEA.

A. HOEN & CO. BALTIMORE, MD.

PLATE XIII.

CALLOSAMIA PROMETHEA.

Larval stages.

FIG. 1.—Fourth stage. Bridgham del. Food, wild cherry; August 7, 1888. Packard notes: "Incomplete, no spinules drawn," also "this is Riley's fifth stage."

FIG. 2.—Last stage, going to spin. Joutel del. 2b, tubercle on penultimate segment of another larva, but only one had this tubercle black-tipped.

FIG. 3.—*Callosamia promethea;* pupa.

CALLOSAMIA ANGULIFERA.

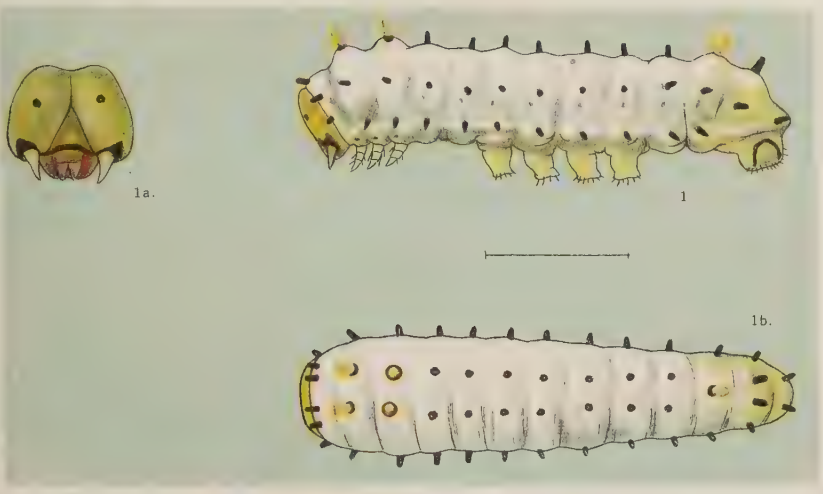
Larval stages. Bridgham del. Food, tulip tree.

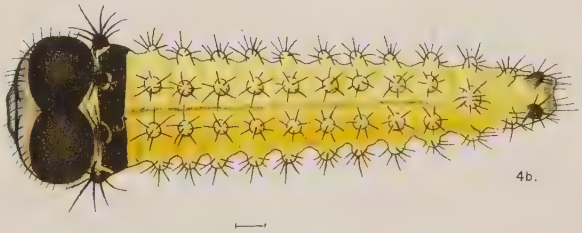
FIG. 4.—First stage, July 8. 1a, front of head. "The seven spines on the *light* tubercles are light colored and transparent, and have *no* black outlines." (Bridgham.)

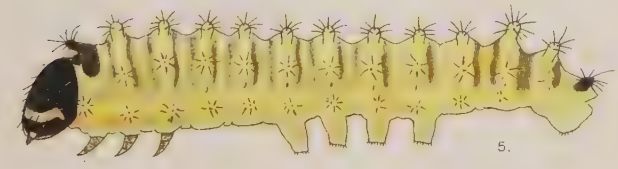
FIG. 5.—Larva, July 13. 2a, sixth segment. Presumably second stage, but not so marked.

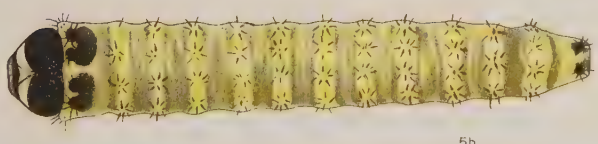
FIG. 6a.—Head of larva, July 15. Presumably third stage.

FIG. 6b.—Dorsal tubercles of same larva.









Bridgham and Joutel, del.

LARVÆ OF CALLOSAMIA.

A. HOEN & CO. BALTIMORE, MD.

PLATE XIV.

CALLOSAMIA ANGULIFERA.

Larval stages. Bridgham del. Food, tulip tree.

FIG. 1.—Larva, July 15. Presumably third stage.
FIG. 2.—Larva, July 19. End of third stage (note by Packard). 2a, tubercle.
FIG. 3.—Larva, July 26. Fourth stage (note by Packard). 3a, dorsal tubercle, second and third thoracic segments; 3b, dorsal tubercle, penultimate segment; 3c, dorsal tubercle, first and second rows; 3d, tubercle of lower row.
FIG. 4.—Larva, August 1. 4a, front of head; 4b, top of last segment.
FIG. 5.—Moth; a variety from Winter Park, central Florida. Bridgham del.

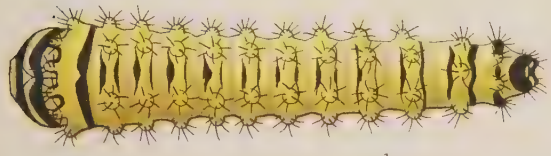
AGAPEMA GALBINA.

FIG. 6.—Larva; length about 45 mm. Joutel del.

1.

2b

2a.



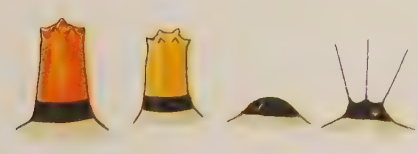
1a.

2.

3.

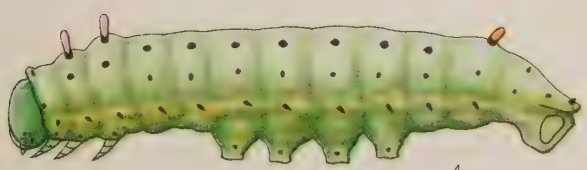
5.

3e.

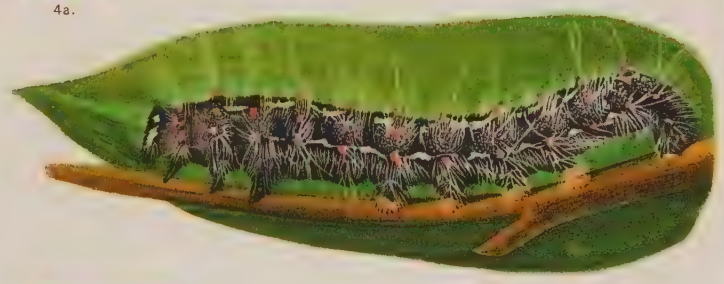


3a. 3b. 3c. 3d.

4a.



4.



6.

4c.

4b

Bridgham and Joutel, del.

CALLOSAMIA AND AGAPEMA.

A. HOEN & CO. BALTIMORE, MD

PLATE XV.

TROPAEA LUNA.

Larval stages. Bridgham del. Food, walnut

FIG. 1.—First stage, July 24, 1888. 1c, dorsal tubercle on sixth segment.

FIG. 2.—First stage, August 24. Another variety.

FIG. 3.—Second stage; "in each stage hairs and spines are transparent and light colored" (Bridgham); "this will apply to part of the brood, but in some the thoracic, especially meso- and metathoracic tubercles, are brown at end, and the setæ are black, as also eighth abdominal single tubercle, and the legs are a little dusky" (Packard). 3b, spiracle; 3c, tubercle, third row; 3d, tubercle, third row, lateral view.

FIG. 4.—Third stage. 4B, dorsal tubercle, sixth segment.

Face.

2b.

1b.

1.

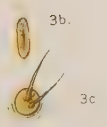
1c

1a.

2.

2a.

3

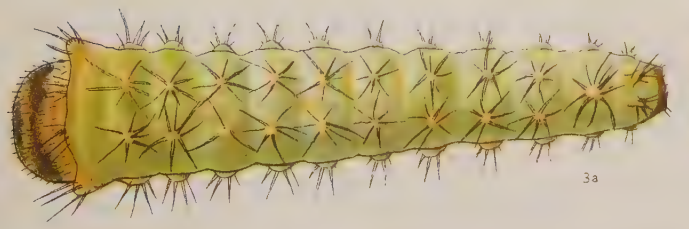


3b.

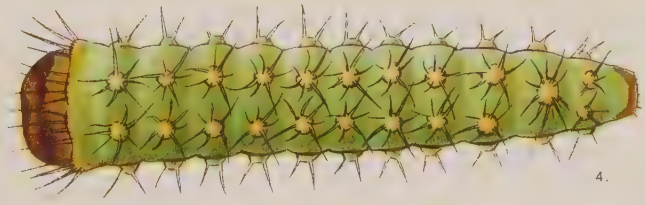
3c

3d.

4B



3a



4.

Bridgham, del.

LARVÆ OF TROPÆA LUNA.

A.HOEN & CO. BALTIMORE, MD

PLATE XVI.

TROPAEA LUNA.

Larval stages. Bridgham del.

FIG. 1.—Third stage. Food, walnut.

FIG. 2.—Fourth stage. Food, walnut. 2b, dorsal tubercle of eleventh segment.

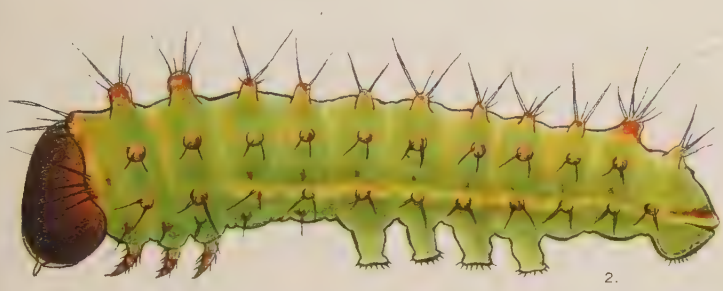
FIG. 3.—Fifth stage, August. Food, walnut. 3b, front of head; 3c, dorsal tubercle of second and third segments; 3d, sixth segment; 3c, hair, numerous on posterior segments, "these hairs also in fourth stage" (Packard).

FIG. 4.—Sixth stage. 4b, front of head; 4c, caudal end from behind; 4d, 4e, tubercles.

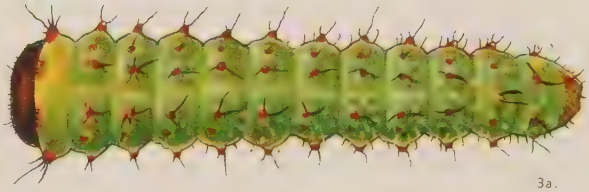
FIG. 5.—Head of last stage, August 23. Food, oak.

1

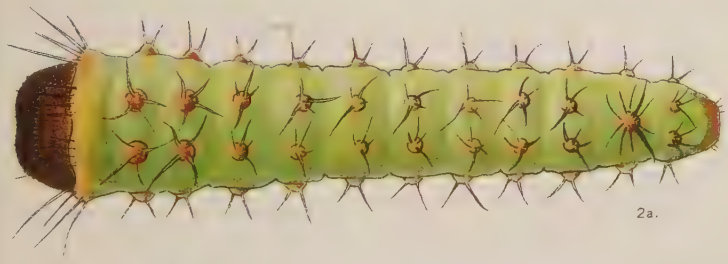
3



2.

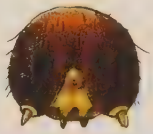


3a.



2a.

2b.

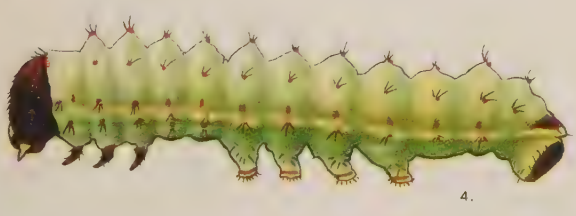


3b.

3c

3d.

3e.



4.

4b.

4d.

4c.

4e

4a.

5.

Bridgham, del.

LARVÆ OF TROPÆA LUNA.

A.HOEN & CO. BALTIMORE, MD.

PLATE XVII.

TROPAEA LUNA.

FIG. 1.—Larva, last stage, August 23. Food, oak. Bridgham del. "Should be pea-green" (Packard).

ACTIAS SELENE.

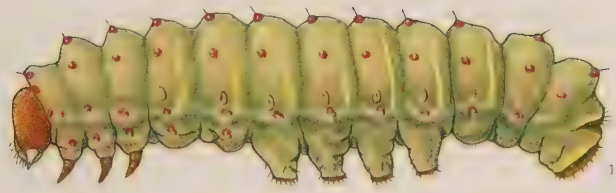
FIG. 2.—Larva. Knight del.

TELEA POLYPHEMUS.

FIG. 3.—Larva, just hatched. Joutel del.

FIG. 4.—Egg, July 20. 4a, egg, natural size. "On oak, white birch and wild indigo." Bridgham del.

FIG. 5.—Larva, first stage, July 28. "Food, oak, wild cherry, wild indigo." (Bridgham). Bridgham del.



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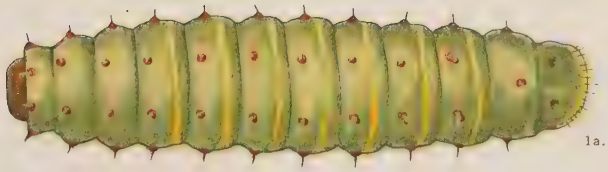
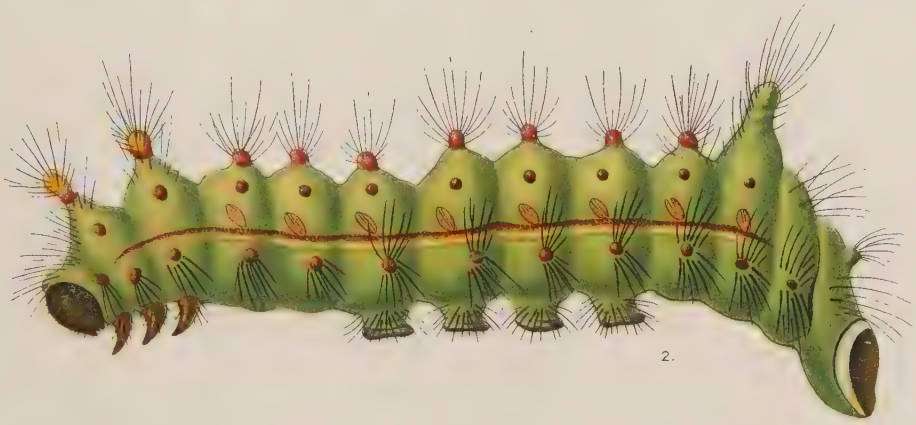
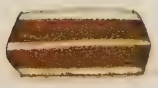


1a.



2.

4.



4a.

3

5.

3a.

5a.

Joutel, Bridgham and Knight, del.

TROPÆA, ACTIAS AND TELEA.

A. HOEN & CO. BALTIMORE, MD.

PLATE XVIII.

TELEA POLYPHEMUS.

Larval stages. Bridgham del.

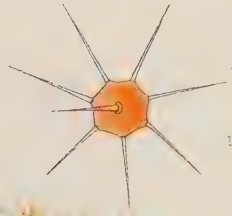
FIG. 1.—Second stage, August 1, 1888. Food, oak and white birch. 1A, head from front; 1B, tubercle, first segment; 1C, tubercle, second segment; 1D, dorsal and lateral tubercles.

FIG. 2.—Third stage. Food, white birch.

FIG. 3.—Fourth stage. Food, white birch. 3A, position at rest; 3B, tubercle of second row.

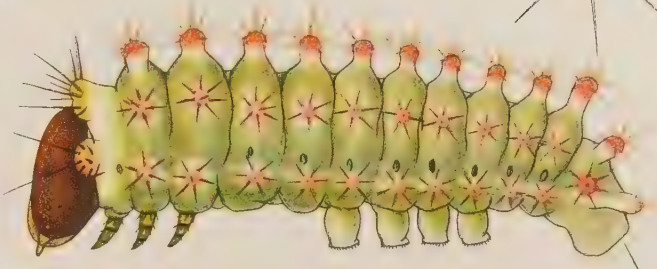
FIG. 4.—Second stage; a different color variety. 4A, sixth segment, "showing number of spines on tubercles;" 4B, second segment; 4C, tubercles of first segment; 1D, tubercle of eleventh segment. "The fine spines are transparent; central ones and those of first, second, and third segments are dark" (Bridgham). Hair too short on 4E (Packard).

4E.

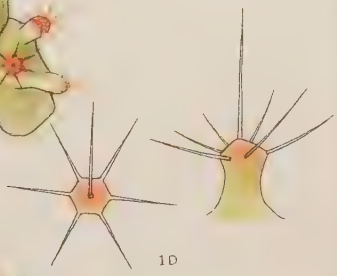


1C.

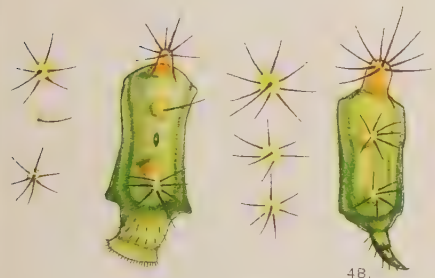
4.



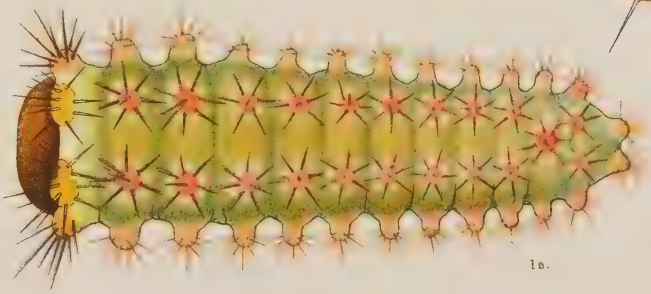
1.



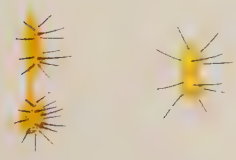
1D.



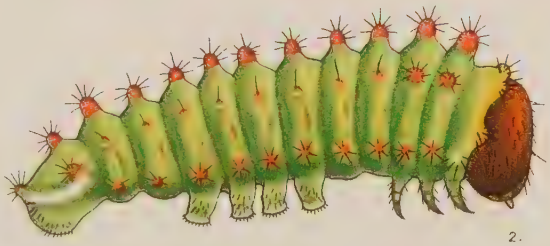
4A. 4B.



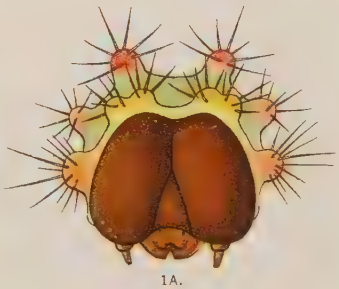
1a.



4C. 4D.

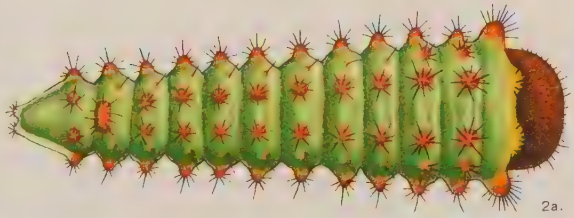


2.

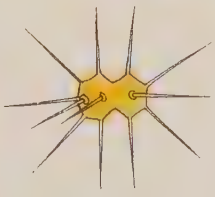


1A.

3A.

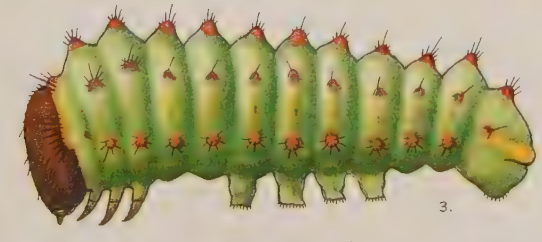


2a.



1B.

3B.



3.

3C.

LARVÆ OF TELEA POLYPHEMUS.

Bridgham, del.

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PLATE XIX.

AUTOMERIS PAMINA.

FIGS. 1 TO 3.—Three stages of larva, from Neumoegen collection. Bridgham del. 1a, 2a, fifth and sixth segments, enlarged; 3a, section of fifth and sixth segments.

FIGS. 4 TO 6.—Larva, collected by Kunzé at Phoenix, Ariz. Joutel del.

FIG. 4.—Last stage.

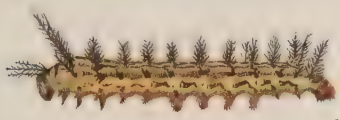
FIG. 5.—Fifth and sixth segments, enlarged.

FIG. 6.—Head.

AUTOMERIS IO.

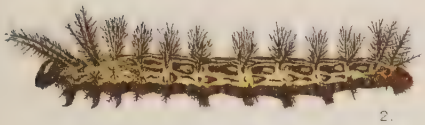
Larval stages. Bridgham del.

FIG. 7.—First stage, July 24. "Food, oak, wild cherry, white birch, wild indigo." 7A, head; 7B, head and first thoracic segment, from above; 7C, section of second segment; 7D, section of sixth segment; 7E, section of eleventh segment; 7F, twelfth segment from behind; 7G, apical part of spine.



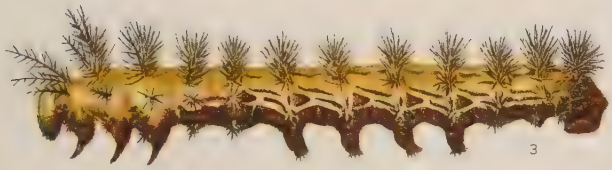
1

6



2.

4



3

4a.

1a.

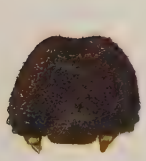
2a.

3a.

5

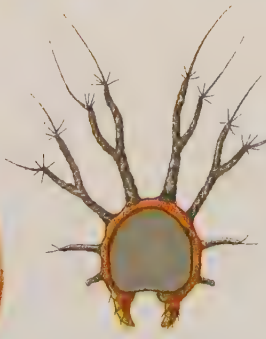
7

1g.



7a.

7b.



7c.

7d.

7e.

7f.

Bridgham and Joutel, del.

LARVÆ OF AUTOMERIS.

A HOEN & CO. BALTIMORE, MD

PLATE XX.

AUTOMERIS IO.

FIG. 1.—Larva, second stage, August 1, 1888. Bridgham del. Food, wild cherry. 1C, section of second segment; 1D, section of sixth segment; 1E, dorsal tubercle.

AUTOMERIS BOUCARDI ("probably").

FIG. 2.—Larva; length 62 mm. Joutel del.

AUTOMERIS CORESUS.

FIG. 3.—Larva; length 52 mm. Buenos Aires (Amer. Mus. Nat. Hist.).
FIG. 4.—Larva; later stage. Natural size. Buenos Aires.

AUTOMERIS VIRIDESCENS.

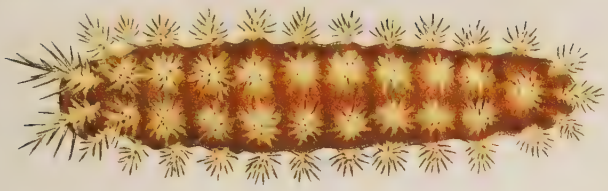
FIG. 5.—Larva; length 40 mm. Buenos Aires. Joutel del.
FIG. 6.—Larva; natural size. Buenos Aires. Joutel del.

COLORADIA (EUDYARIA) VENATA.

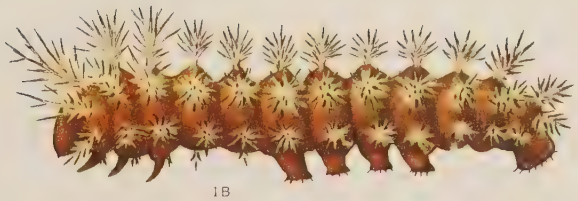
FIG. 7.—Larva. Buenos Aires. Joutel del.

COLORADIA PANDORA.

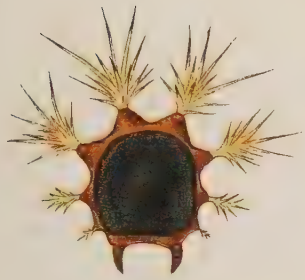
FIG. 8.—Larva. Fort Klamath, Oreg., August 30, 1894. Bridgham del. 8a, tubercle of first stage larva; 8b, tubercles on first, second, and third segments of first stage larva; 8c, first stage larvæ; natural size.



1A.



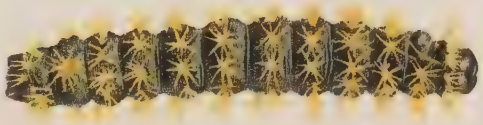
1B



1C.

1D.

1E.



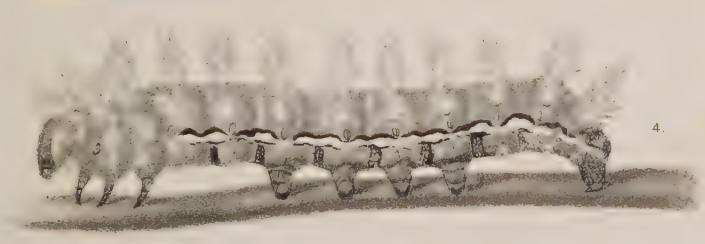
6.

6a.

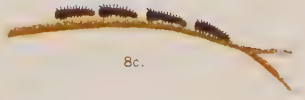
2.

5.

3.

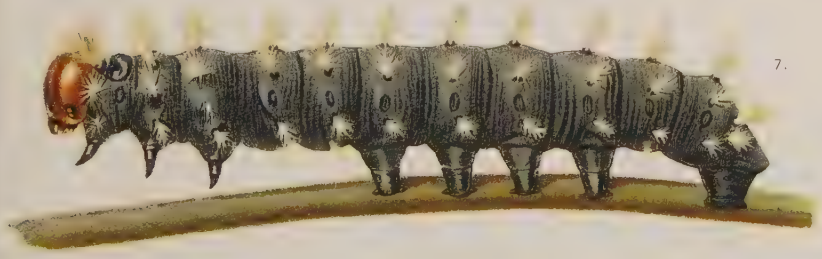


4.



8c.

8a. 8b.



7.

Bridgham and Joutel, del.

LARVÆ OF AUTOMERIS AND COLORADIA.

A. HOEN & CO. BALTIMORE, MD

PLATE XXI.

COLORADIA PANDORA.

FIG. 1.—Larva, first stage. Fort Klamath, Oreg., August 30, 1894. Bridgham del.

HEMILEUCA MAIA.

Larval stages. Bridgham del.

FIG. 2.—First stage; "brought by Dr. Packard, May 11, 1893." Food, *Salix*. 2b, five-pointed crown of tubercle and base of hair; 2c, two-haired tubercle, dorsal on two first segments; 2d, tubercle of second row, with one hair; 2e, tubercle of third row, with two hairs.

FIG. 3.—First stage, a different color variety. Lonsdale, R. I., June, 1893. Food, oak. 3d, dorsal tubercle of first three segments; 3b, dorsal tubercle.

1.

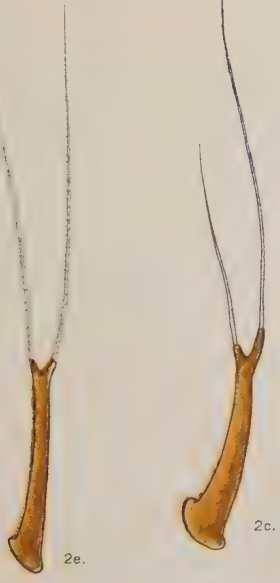
1a.

3b. 3a.

2d.

2b.

2.


2e. 2c.

2a.

Bridgham, del.

LARVÆ OF COLORADIA AND HEMILEUCA.

A. HOEN & CO. BALTIMORE, MD.

PLATE XXII.

HEMILEUCA MAIA.

FIG. 1.—First stage. Lonsdale, R. I., June, 1893. Food, oak. Bridgham del.

FIG. 2.—End of first stage (labeled second stage by Bridgham, corrected by Packard). Lonsdale, R. I., June. Food, oak; 2c, dorsal tubercle of first three segments; 2d, dorsal tubercle. Bridgham del.

FIG. 3.—Second stage; length 10 mm. June 19. 3b, natural size; 3c, segment.

FIG. 4.—Next to last stage, about to molt; length 44½ mm.

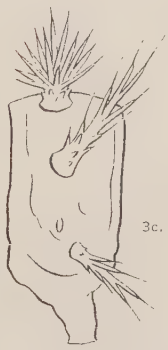
1.

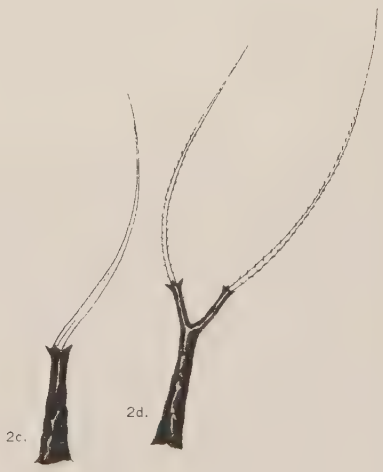
2.

1a.

2a

3a

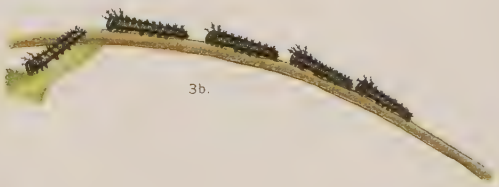

3c.


2c.

2d.

3

4a


3b.

4.

Bridgham, del.

LARVÆ OF HEMILEUCA MAIA.

A.HOEN & CO. BALTIMORE, MD

PLATE XXIII.

HEMILEUCA ARTEMIS.

FIG. 1.—Female. Las Cruces, N. Mex. Thorax rubbed in middle. Olive J. Cockerell del.

FIG. 2.—Larva. New Mexico, June 1, 1893. Food, *Salix*. Bridgham del. 2, 2a, natural size; 2b, dorsal tubercle, second segment; 2c, sixth segment.

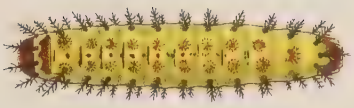
FIG. 3.—Larva; fourth stage? New Mexico, June 1, 1893. Food, *Salix*. 3a, subdorsal tubercle; 3b, sixth segment; 3c, first segment; 3d, fourth segment; 3c, eighth segment; 3f, twelfth segment. Bridgham del.

FIG. 4.—Larva; third stage. New Mexico, June 2, 1893. Food, *Salix*. 4a, natural size; 4b, dorsal tubercle; 4c, sixth segment. Bridgham del.

FIG. 5.—Larva; last stage. June 16, 1893. Bridgham del.

FIG. 6.—Larva of *H. yavapai*. Edwards collection. Bridgham del.

1.


2a.

2c.

3a.

3b.

2.

3.

3c.

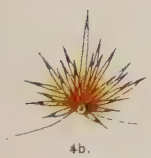
3d.

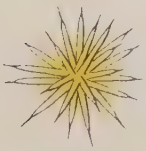
2b.

4.

4a.

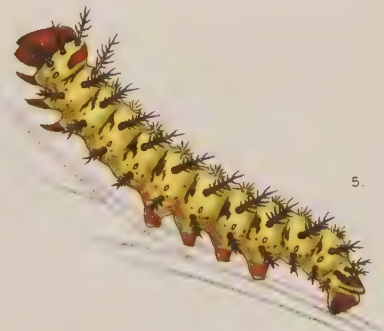
4c.

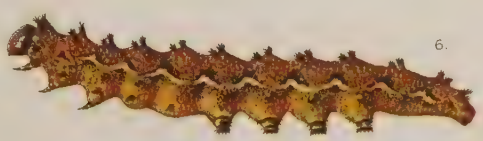

4b.



3e.

3f.


5.


6.

HEMILEUCA.

Bridgham and Olive Cockerell, del.

A. HOEN & CO. BALTIMORE, MD.

PLATE XXIV.

HEMILEUCA NEUMOEGENII and H. BURNSI.

FIG. 1.—Male moth from collection United States Department of Agriculture. Los Angeles, Cal. Bridgham del. [Bridgham labels this *H. neumoegenii;* Packard adds, "variety, correct." It is undoubtedly *H. burnsi*, which had not been separated at that time.]

FIG. 2.—*H. neumœgenii*, larva. Los Angeles County, Cal. Bridgham del. Packard adds, "correct." 2d, sixth and seventh segments. [This has the same number as the moth, fig. 1 (532 Dept. Agr.), and must be *H. burnsi.*]

FIG. 3.—Undetermined larva on *Eriogonum fasciculatum*. San Bernardino County, Cal., April, 1887. No. 359, United States National Museum. Bridgham del. 3a, dorsal view of sixth segment; 3b, side view of sixth segment; 3c, tubercle of third row; 3d, dorsal tubercle.

[Is this the genuine *H. neumoegenii*, or is it *H. electra?* In the records at Washington it is called *Pseudohazis hera*. The larvæ were found by Koebele, who fed them on leaves of plum and apricot, which they devoured, but all died before pupating. Watson has larvæ of *H. electra* found on *Eriogonum fasciculatum;* see Plate CXII.]

HEMILEUCA OLIVIÆ.

FIG. 4.—Larva. New Mexico. [From an alcoholic specimen, not showing the natural colors.]

PSEUDOHAZIS EGLANTERINA.

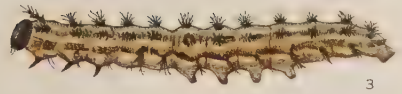
FIG. 5.—Aberration of male. Oregon. "From Riley." Bridgham del.

FIG. 6.—Young larva; length 3½ mm. California, on cherry, May 19. Bridgham del. 6b, dorsal spines; 6c, lateral spine; 6f, section of sixth segment; 6g, section of eleventh segment.

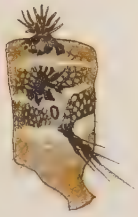
1.

2

2a.

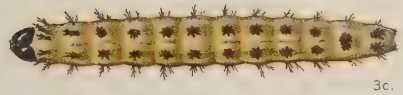

3

3a


3b.

3c.

3d.


3c.

4.

4a

6a.

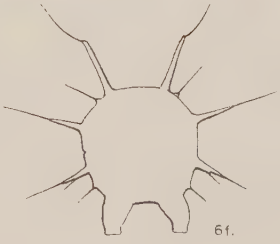
6.

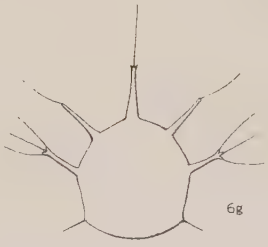
5.

5a.

6b.

6c.


6f.


6g

HEMILEUCA AND PSEUDOHAZIS.

Bridgham, del.

A. HOEN & CO. BALTIMORE, MD.

83570°—14——22

PLATE XXV.

PSEUDOHAZIS EGLANTERINA.

FIG. 1.—Young larva (same as fig. 6, Pl. XXIV). 1a, section of first segment; 1b, section of second segment. Bridgham del.

FIG. 2.—Second stage; length 8 mm. June 16, 1893. Bridgham del. 2b, natural size; 2c, dorsal spines; 2c and 2d, spines of second and third rows presumably, but not labeled.

PSEUDOHAZIS SHASTAENSIS.

FIG. 3.—Larva of second stage, ready to molt. Kaslo (Dyar). Joutel del. Labeled *Hemileuca californica*, but corrected by Packard to "*shastaensis*, form."

PSEUDOHAZIS HERA.

FIG. 4.—Larva; June 1, 1896. Montana (Wiley). Food, wild sage [i. e., *Artemisia*]. Bridgham del. 4a, tubercle of dorsal row; 4b, tubercle of dorsal row, first segment; 4c, 4d, 4e, sections of first, third, and sixth segments; 4g, sixth segment; 4h, larva, natural size.

LARVÆ OF PSEUDOHAZIS.

Bridgham and Jontel, del.

A. HOEN & CO. BALTIMORE, MD.

PLATE XXVI.

ATTACUS ATLAS.

FIG. 1.—Adult larva. After Poujade, Ann. Soc. Ent. France, Ser. V, Vol. X (1880), Pl. 8, fig. 8.

ANTHERAEA YAMAMAI.

Larval stages. Joutel del.

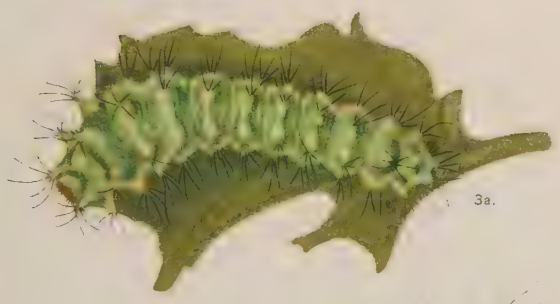
FIG. 2.—End of first stage. May, 1901. Length 11 mm.
FIG. 3.—Second stage, "about molting." May 18, 1901. Length 17 mm.
FIG. 4.—Third stage. Length 35 mm.
FIG. 5.—Last (fifth) stage. Natural size.

1.

2

3

2a.



3a.

5.

4.

4a.

5a.

PLATE XXVII.

ANTHERAEA PERNYI.

Larval stages. Joutel del.

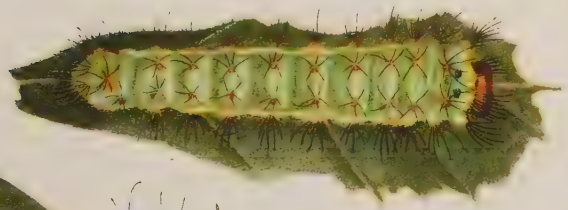
Fig. 1.—First stage.
Fig. 2.—Second stage; molting.
Fig. 3.—Third stage.
Fig. 4.—Third stage; just molting into fourth stage; no silvery spots.
Fig. 5.—Fourth stage; molting into fifth. Length 46–52 mm., according to degree of contraction.
Fig. 6.—Last (fifth) stage.

1.

1a.

2.

2a.



3.

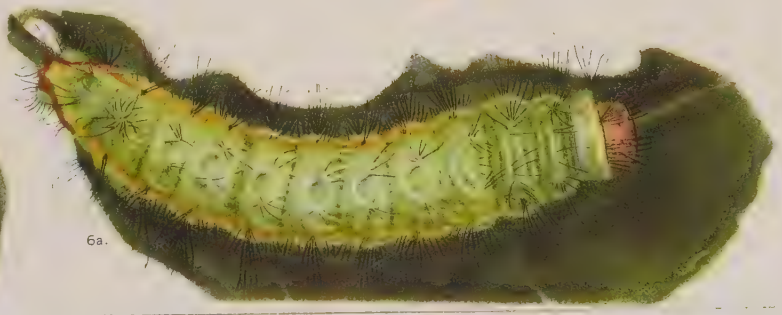
3a.

4

5.

5a.

6.


6a.

L. H. Joutel, del.

LARVÆ OF ANTHERÆA PERNYI.

A. HOEN & CO. BALTIMORE, MD.

PLATE XXVIII.

ANTHERAEA MYLITTA.

FIG. 1.—Larva. Poujade del. Natural size. "Green, with reddish lateral line; tubercles golden yellow, much as in *Telea polyphemus*." The drawing is from a blown larva.

CALIGULA JAPONICA.

Larval stages. Joutel del.

FIG. 1.*—First stage; about to molt.
FIG. 2.—Second stage; about to molt. Length 18 mm.
FIG. 3.—Third stage.
FIG. 4.—Fourth stage. Length about 45 mm. Fifth stage is similar; "spines do not show, as they are so light."
FIG. 5.—Fourth stage; dark form. The majority are like figure 4, and there are all intermediate variations between these extreme forms; some had still less black than figure 4.

RHODIA FUGAX.

FIG. 6.—Larva, last (fifth) stage. Natural size, but 78 mm. long when walking. Joutel del. "Larva in last stage makes a squeaking noise by moving head up and down on prothorax."

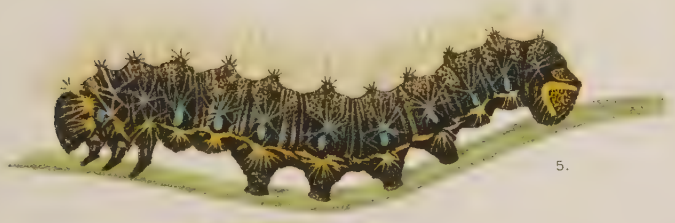
1.

1*

4

4a.

2.



5.

2a

3a.

3.

6.

6a.

PLATE XXIX.

RHODIA FUGAX.

Larval stages. Joutel del.

FIG. 1.—End of first stage. The commonest color form.

FIG. 2.—End of first stage. Form with least black.

FIG. 3.—End of first stage. Blackest form. All variations exist between these three.

FIG. 4.—Second stage. Same form as figure 2. "Some have still less black than this." There are all variations in the amount of black between this and the dark larvæ (fig. 5); those with much black have tubercles on second segment black, the others have them blue (Joutel).

FIG. 5.—Second stage. Form with most black, same as figure 3. Some have as much black, but the second and third pair of dorsal tubercles are blue as in the light forms.

FIG. 6.—Third stage. "All the larvæ are gradually losing the black;" the dark ones have only the base of dorsal tubercles on third and eleventh segments black, the tips blue; the lower half of face is black (Joutel).

1.

2.

1a.

2a.

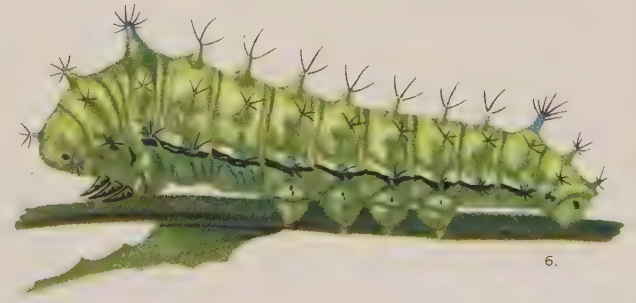
3.

4a.

5.

4.

5a.



6.

PLATE XXX.

RHODIA FUGAX.

Larval stages. Joutel del.

FIG. 1.—Third stage.

FIG. 2.—Fourth stage. Length about 46 mm. The larva is at the end of the stage, and ready to molt. In this stage all the larvæ are alike, no matter what the color was in the earlier stages (Joutel).

RHODIA NEWARA.

FIG. 3.—Cocoon. Knight del.

TAGOROPSIS FLAVINATA.

FIG. 4.—Larva. "Tubercles multisetose; has prothoracic and suranal plate tubercles; caudal horn fuses divided." (Packard.)

COPAXA MULTIFENESTRATA.

FIG. 5.—Larva; first stage. Mexico. Joutel del.

LOEPA KATINKA.

FIG. 6.—Larva. Knight del.

FIG. 7.—Cocoon. Knight del.

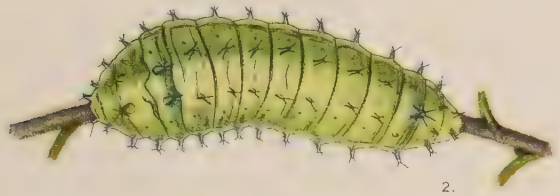
PERISOMENA CAECIGENA.

FIG. 8.—Larva. British Museum.. Knight del.

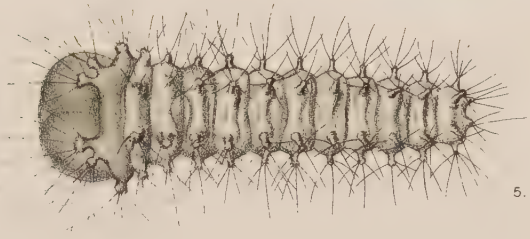
FIG. 9.—Cocoon. British Museum. Knight del.

1.

4.



2.



5.

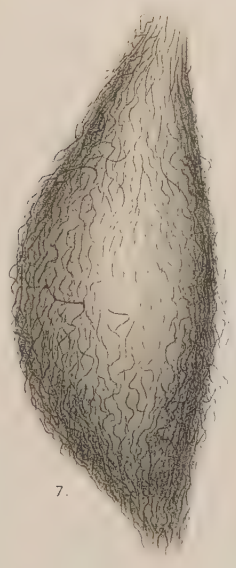
2a.

5a.

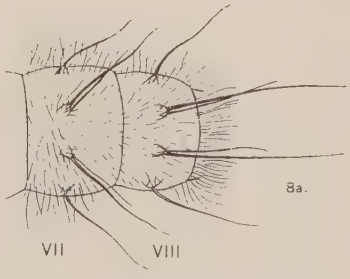
6.

9.

3.



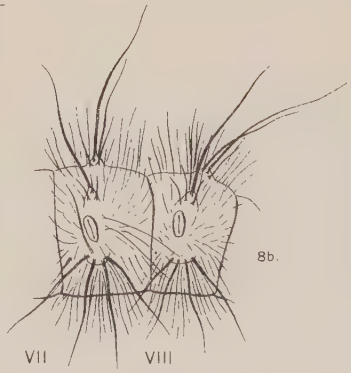
7.



8a.

VII VIII

8.



8b.

VII VIII

PLATE XXXI.

CRICULA TRIFENESTRATA.

FIG. 1.—Larva; from blown specimen; natural size. Himalayas. Knight del. [This agrees with the larva as described by Dr. K. Jordan.]
FIG. 2.—Cocoon of figure 1. Knight del.
FIG. 3.—Caudal end of larva, to show partly fused tubercles. Knight del.
FIG. 4.—Larva. Knight del. [No history accompanies this; it does not agree with Jordan's description.]
FIG. 5.—Cocoon. Knight del.
FIG. 6.—Pupa. Knight del.

LUDIA DELEGORGUEI.

FIG. 7.—Larva. Length about 50 mm. Joutel del.

EUDAEMONIA BRACHYURA.

FIG. 8.—Larva. Length 21 mm. Joutel del.
FIG. 9.—Pupa.

EUDAEMONIA ARGIPHONTES.

FIG. 10.—Larva. Length 31 mm. Joutel del.

SPHINGICAMPID LARVA.

FIG. 11.—Undetermined larva from Irebu, 1,000 miles up the Congo River, Africa. Joutel del.

UROTA SINOPE.

FIG. 12.—Larva. Durban, Natal, March. Joutel del.

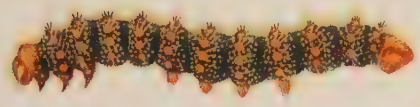
USTA TERPSICHORE.

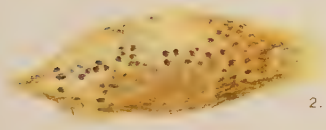
FIG. 13.—Larva. Durban, Natal, April, 1901. Joutel del. Natural size.

CERCOPHANA FRAUENFELDI [VENUSTA, variety].

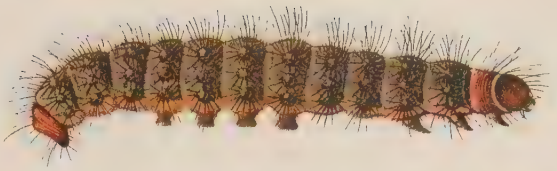
FIG. 14.—Larva. Chile. Knight del.
FIG. 15.—Cocoon. Knight del.

1.


1a.


2.

3.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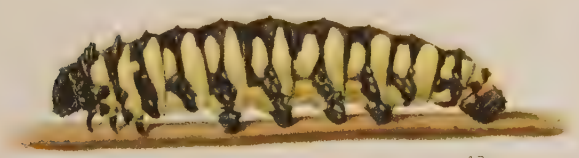
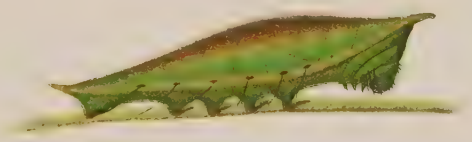
11.

12.


13.


14.

15.

L. H. Joutel and Knight, del.

CRICULA, LUDIA, EUDÆMONIA, UROTA, USTA AND CERCOPHANA.

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PLATE XXXII.

CIRINA FORDA.

FIG. 1.—Larva. Joutel del.

THYELLA TYRRHAEA.

FIG. 2.—Larva. Johannesburg. Horace Knight del. This and figure 3 were obtained by Mr. W. L. Distant from "a friend" who bred them.

NUDAURELIA CYTHEREA.

FIG. 3.—Larva. Johannesburg. H. Knight del.

NUDAURELIA WAHLBERGI.

FIG. 4.—Larva; length about 80 mm. Durban, Natal, March, 1901. Joutel del.

NUDAURELIA DIONE.

FIG. 5.—Larva. Sierra Leone (Amer. Mus. Nat. Hist.). Joutel del.

ACANTHOCAMPA BELINA.

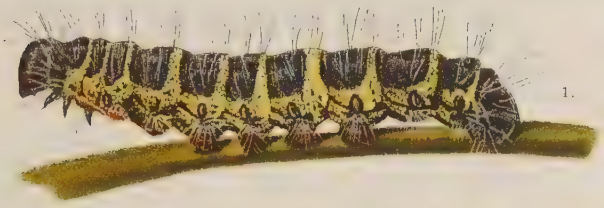
FIG. 6.—Larva; length about 80 mm. Joutel del.
FIG. 7.—Larva; a darker form. Joutel del.

BUNAEA CAFFRARIA.

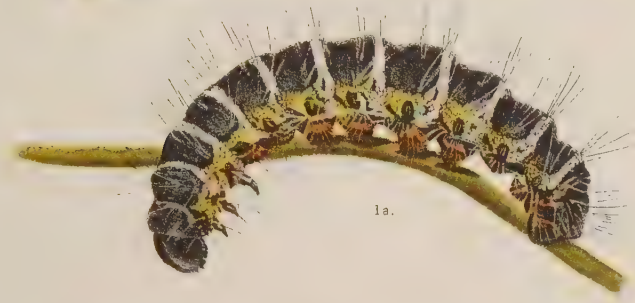
FIG. 8.—Larva. Joutel del.

BUNAEA ALCINOË.

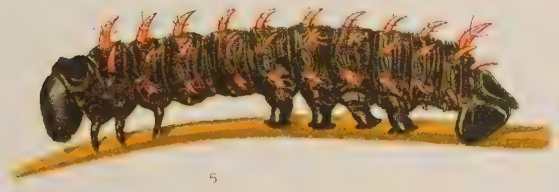
FIG. 9.—Larva. Mukinbungu, Lower Congo. From an alcoholic specimen in Stockholm Museum. Sent by C. Aurivillius, who expresses the opinion that *B. alcinoë* may be only a local race of *B. caffraria*. [Jordan in 1910 described a subspecies *nubica* of *B. caffraria*, from as far north as the Blue Nile.]


1.

2


1a.

3.

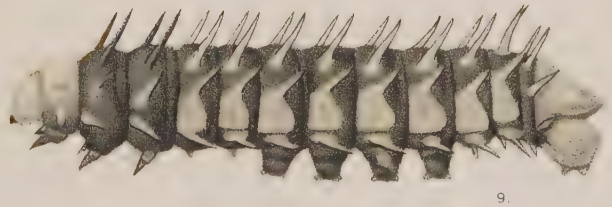

5

4.

7.

6.

8


9.

L. H. Joutel and Knight, del.

CIRINA, THYELLA, NUDAURELIA, ACANTHOCAMPA AND BUNÆA.

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83570°—14——23

PLATE XXXIII.

LOBOBUNAEA PHAEDUSA.

FIGS. 1, 2, 3.—Pupa.
FIG. 4.—Eggs.
FIG. 5.—Larva. Joutel del.

LOBOBUNAEA TYRRHENA.

FIG. 6.—Larva. Joutel del. Natural size.
FIG. 7.—Larva; earlier stage. Joutel del. Length about 60 mm.

MICRAGONE HERILLA.

FIG. 8.—Larva. No. 335, Amer. Mus. Nat. Hist. Joutel del.

HOLOCERA SMILAX.

FIG. 9.—Larva; length about 43 mm. Joutel del.

UNDETERMINED LARVÆ.

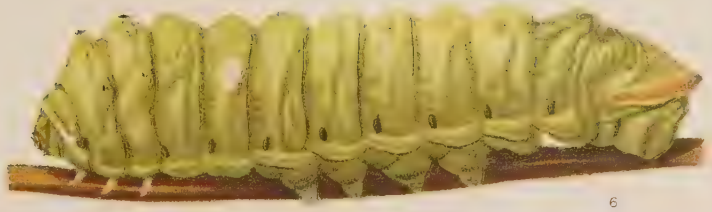
FIG. 10.—Larva from Africa. Paris Museum. Joutel del. [Evidently a species of *Bunaea.*]
FIG. 11.—Larva. No. 1033. American Mus. Nat. Hist. Joutel del. Length about 60 mm.
FIG. 12. Larva from Madagascar. Poujade del. Natural size. "Head turned black; lateral spines dark red. Long lateral tubercles on prothorax as in *atlas!*" (Packard.)
FIG. 13. Larva from Lakhone (Laos), Asia (Dugast). Poujade del. Natural size. "Has long lateral tubercles on prothorax as in *atlas.* Spiracles black, rest of body and spines all green." (Packard.)

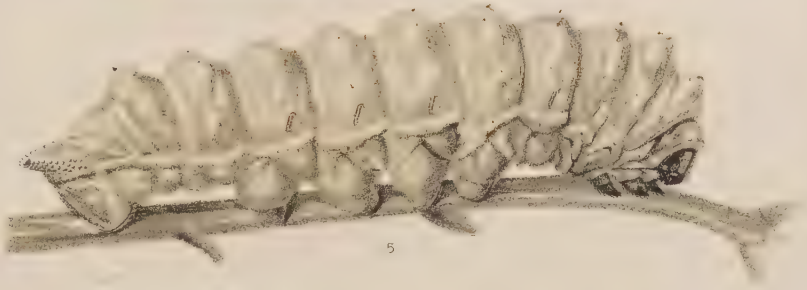
1.

2.

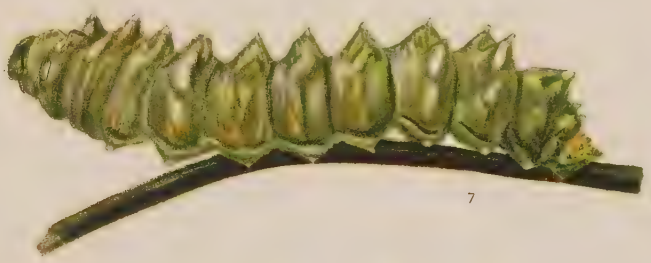
3.

4.


6


5

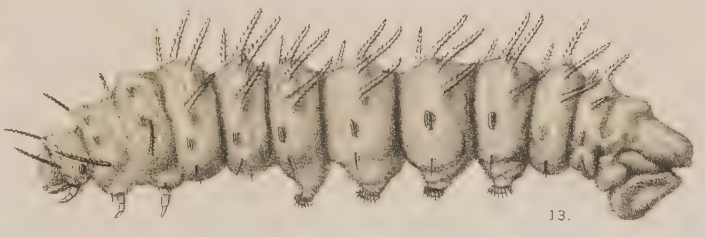
8.


7

9.

10.

11.


13.

12.

L. H. Joutel and Poujade, del.

LOBOBUNÆA, MICRAGONE, HOLOCERA, AND UNDETERMINED LARVÆ.

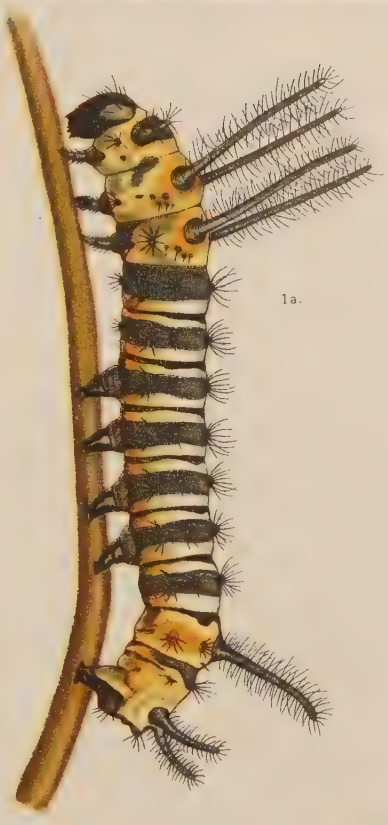
A. HOEN & CO. BALTIMORE, MD.

PLATE XXXIV.

BRAHMAEA JAPONICA (BRAHMAEIDÆ).

Larval stages. Joutel del. Bred from ova from Japan. (Cf. Packard, Proc. Amer. Acad., XXXIX, 1904, No. 22.)

FIG. 1.—First stage; length 8 mm.
FIG. 2.—Second stage; length 16 mm.
FIG. 3.—Third stage.
FIG. 4.—Last stage.
FIG. 5.—End of last stage, a few days before pupating. Legs brownish-yellow, no blue.



L. H. Joutel, del.

LARVÆ OF BRAHMÆA.

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PLATE XXXV.

Fig. 1.—*Cirina forda* (Westwood), ♂. Natal.

Fig. 2.—*Salassa megastica* Swinhoe. Swinhoe 87. Veins very slender. Assam. [*Salassa thespis* (Leech) ab. *megastica* Swinhoe; Rothschild, 1895.]

Fig. 3.—*Thyella tyrrhea* (Cramer), ♂. South Africa.

Fig. 4.—*Bunaea caffraria* (Stoll), ♂. [South Africa.] [Type of genus *Bunaea*, according to Kirby.]

[The localities given within square brackets are those of the species, without reference to the particular individuals figured. In the first part of this series Dr. Packard called the subcostal vein I, the radius II, and so on. In the second part he accepted the work of Enderlein, and named the subcostal vein II, the radius III, and so on. In making up the plates I found one method employed on some figures, the other on others. I have taken the liberty of correcting them, so that all agree with the nomenclature of Dr. Packard's second volume. In the text the descriptions are left as written by Dr. Packard, but notes are added in explanation. Little confusion can arise, as the reader will remember that the subcosta is simple, the radius branched, hence II_1, II_2, etc., can only refer to the radius.]

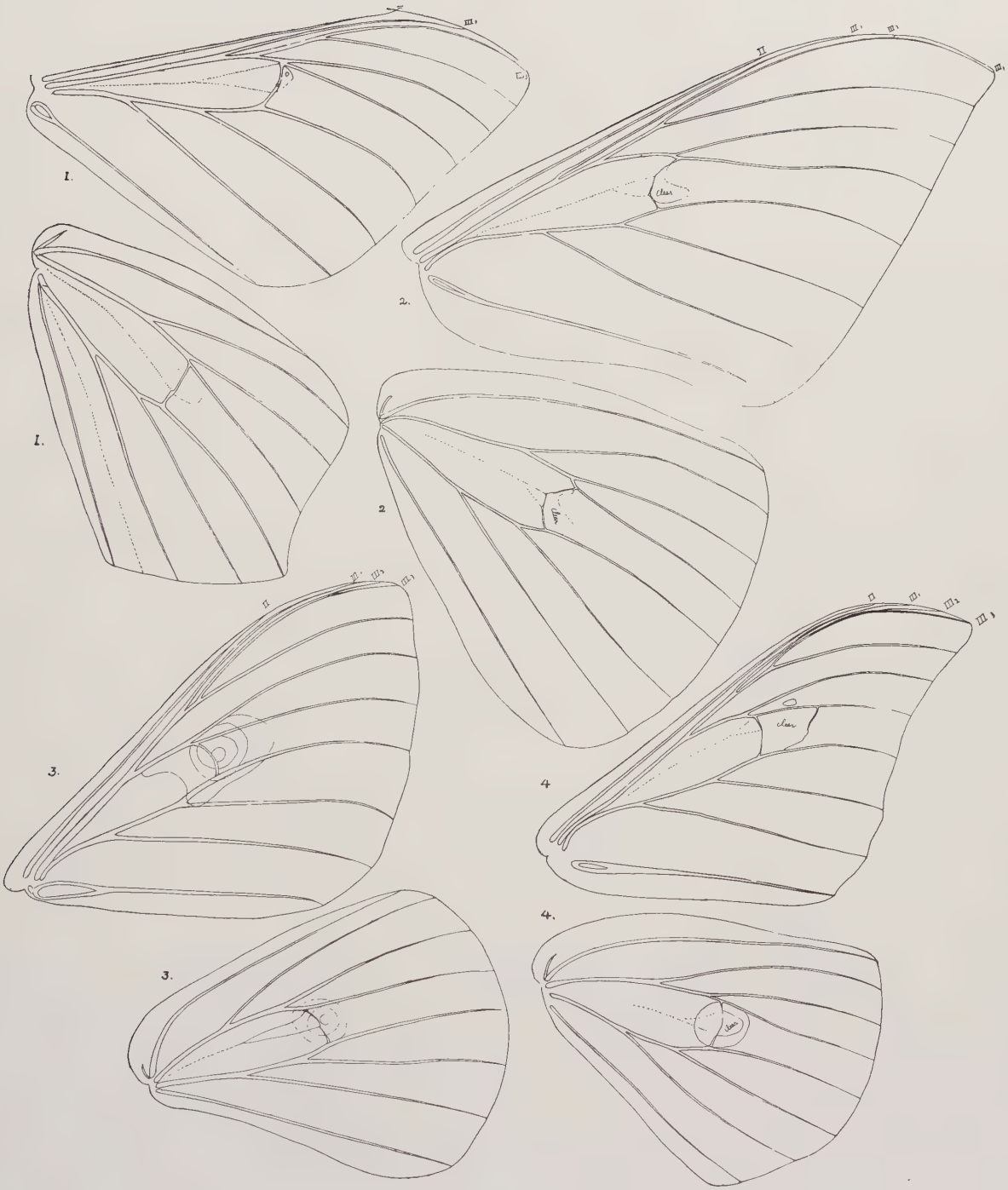

I.
II
III,
III,
III,
clear
2.
I.
2
clear
3.
4
clear
4.
3.
clear

PLATE XXXVI.

FIG. 1.—*Cremastochrysallis arnobia* (Westwood), ♀. [Calabar.]
FIG. 2.—*Oxytenis lamis* (Stoll) [Surinam]. [Dr. Packard has penciled a note, "Very near *A. iol*"]
FIG. 3.—*Eusyssaura honesta* (Stoll), ♂. [Nicaragua to Amazons.]
FIG. 4.—*Gynanisa maia* (Klug). South Africa.

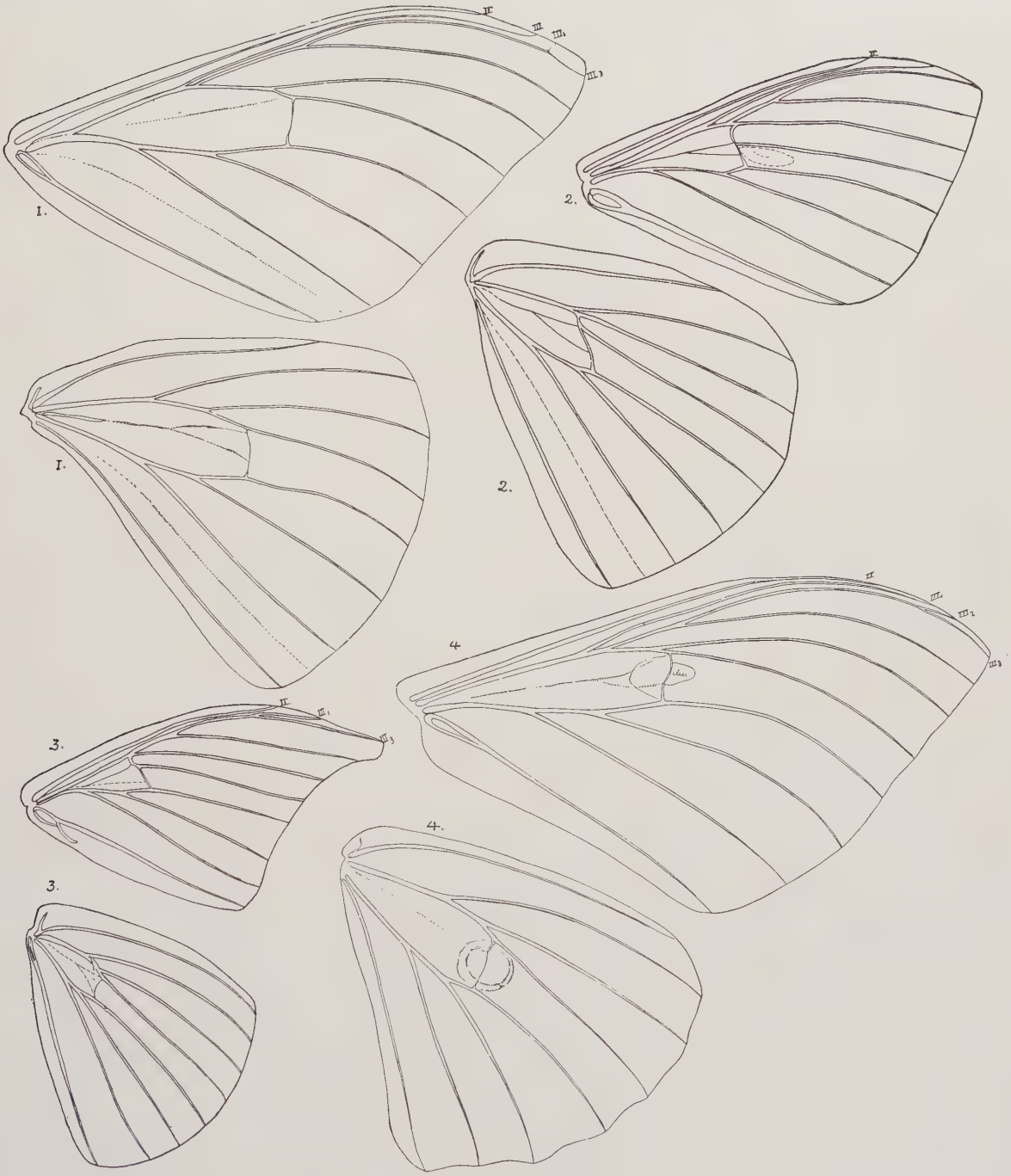

1.
2.
1.
2.
4
4.
3.
3.

PLATE XXXVII.

Fig. 1.—*Nudaurelia dione* (Fabricius), ♂. [West Africa.] [This is *paphia* of Kirby's Catalogue, not of Linné.]
Fig. 2.—*Nudaurelia jamesoni* (Druce), ♀.
Fig. 3.—*Nudaurelia cytherea* (Fabricius), ♂. [According to the figure this differs from the other species of *Nudaurelia* in wanting vein III_2.]
Fig. 4.—*Melanocera menippe* (Westwood), ♂. [Natal.]
Fig. 5.—*Antherina suraka* (Boisduval), ♀. Madagascar. Apex of III_1 and III_3 as in *N. cytherea;* no III_2.

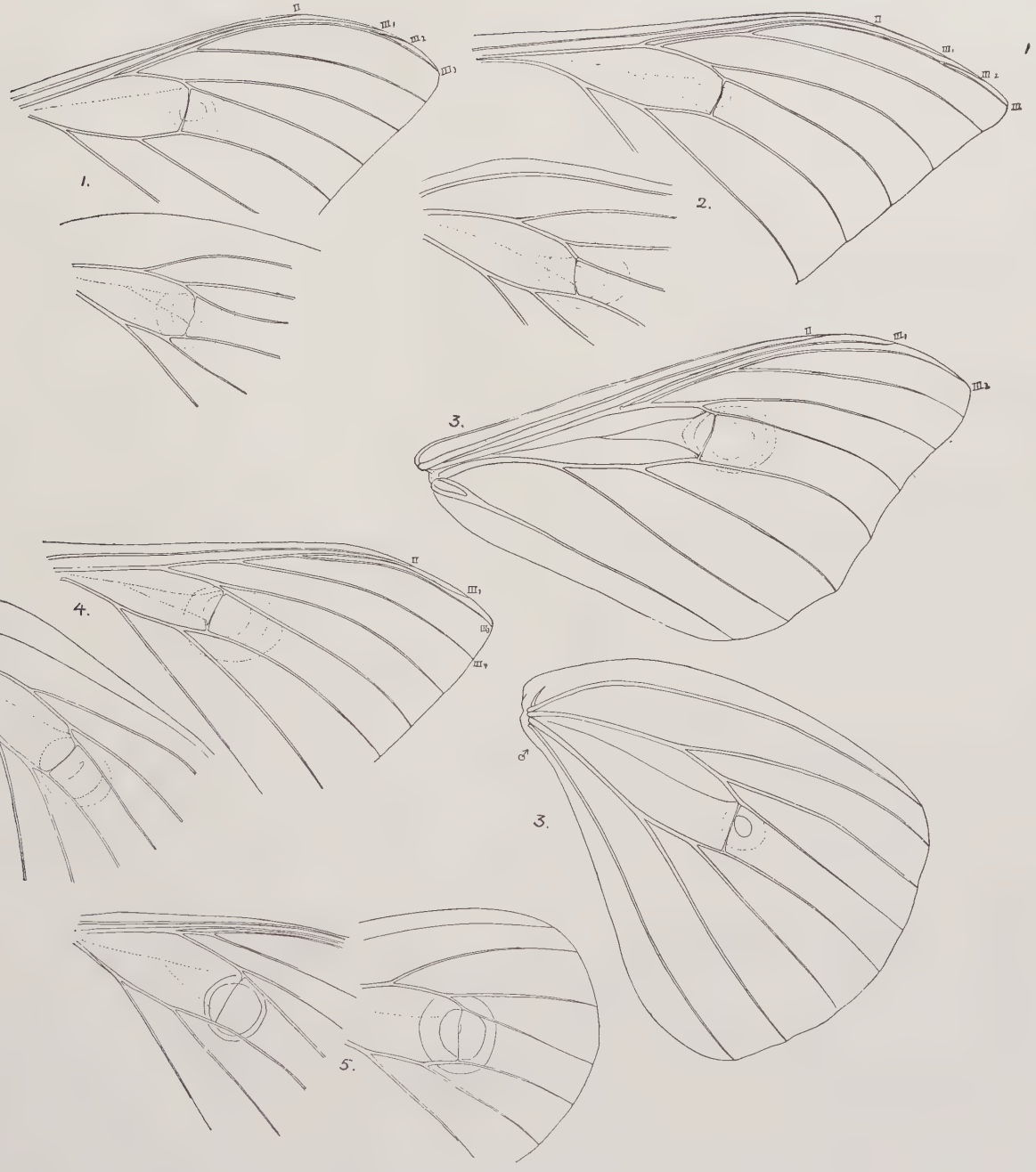

1.
2.
3.
4.
3.
5.

PLATE XXXVIII.

FIG. 1.—*Saturnia boisduvalii* Eversmann. [Siberia.]
FIG. 2.—*Perisomena caecigena* (Kup.). [Southeast Europe, western Asia.]
FIG. 3.—*Cricula trifenestrata* (Helf). ♀. [Asia.]
FIG. 4.—*Heniocha* [*Eriogyna*] *pyretorum* (Westwood). ♀. [East Indies.] The veins are thick.
FIG. 5.—*Heniocha apollonia* (Cramer). ♀. [South Africa.] [Type of genus, according to Kirby.]
FIG. 6.—*Loepa katinka* (Westwood). ♂. [North India, Java.] Discal veins almost interrupted, i. e., not quite meeting, the connecting portion nearly obsolete.

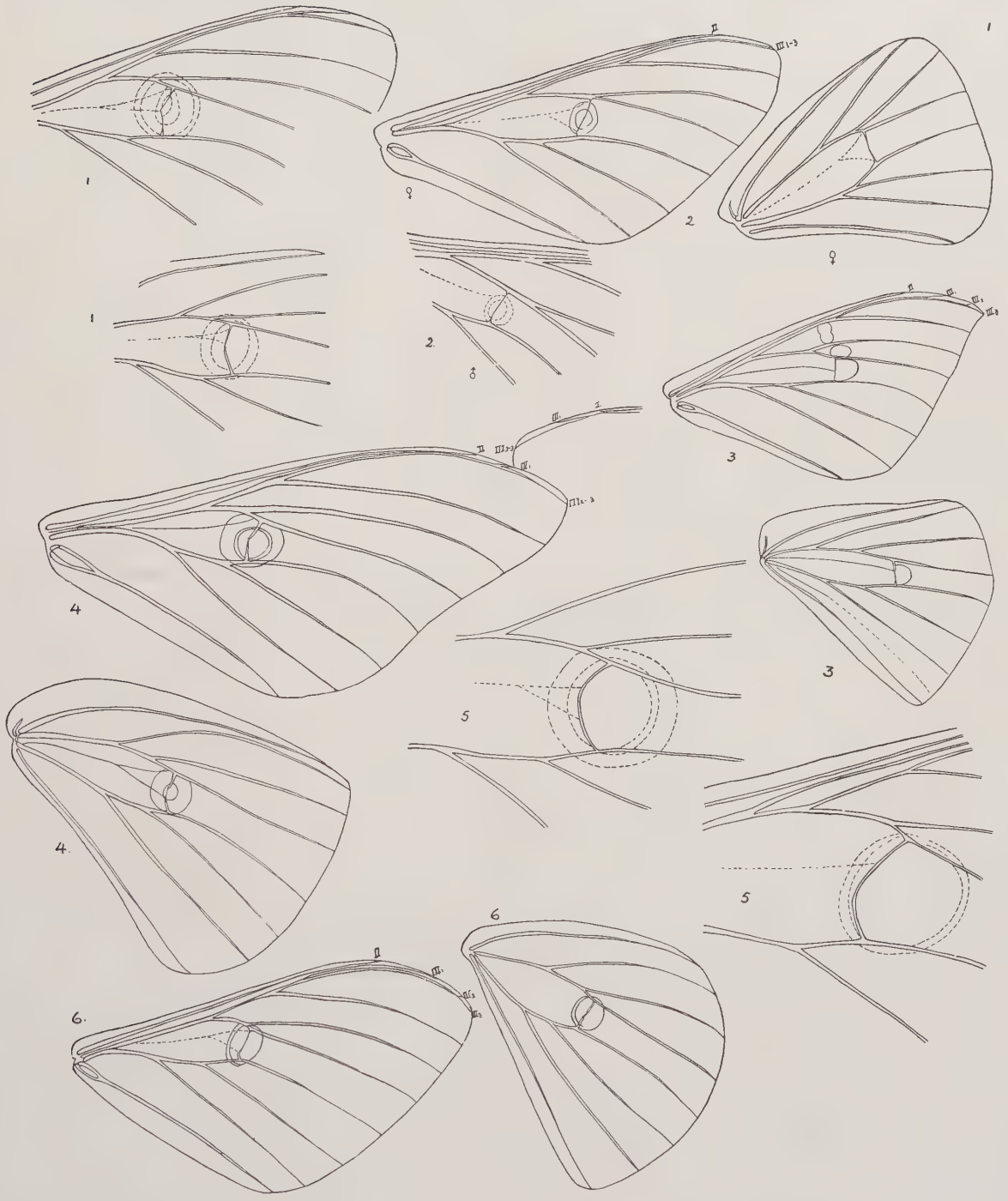

1
♀
2
1
♀
1
2
♂
3
4
3
5
4.
5
6.
6

PLATE XXXIX.

FIG. 1.—*Copaxa multifenestrata* (H.-Schäff.), ♂.

FIG. 2.—*Copaxa chapata* (Westwood). ♂. Anterior wing; III_1, vestigial, a short stump. Hind wing with no discal fold. [Penciled note.]

FIG. 3.—*Copaxa denda* Druce. ♀. [Mexico.]

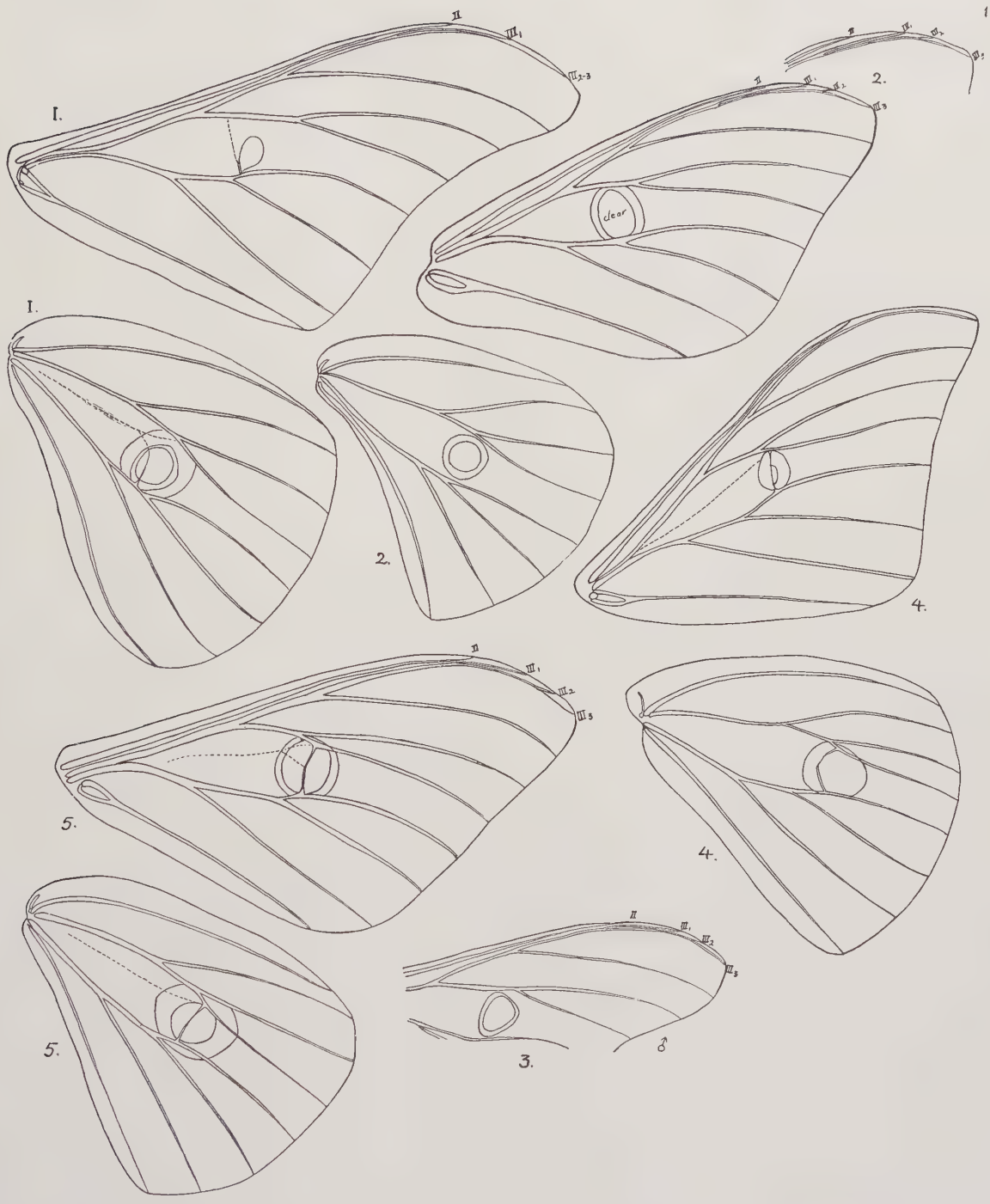
FIG. 4.—*Copaxa decrescens* Walker. ♂. Hind wing with lower discal vein a stump. [Type of genus.]

FIG. 5.—*Copaxa disjuncta*. ♂. Scales very dense. The two discal veins of hind wing do not meet.

1
2
3
4
5

PLATE XL.

Fig. 1.—*Rhodia newàra* Moore. Type ♂. [Nepal.] [Type of genus.]
Fig. 2.—*Rhodia fugax* Butler. ♀. [Japan.] No discal veins.
Fig. 3.—*Rhodia fugax* Butler. ♂.
Fig. 4.—*Caligula japonica* Butler. ♂. [Japan.]
Fig. 5.—*Caligula helena* (White). ♀. [Australia, Tasmania.]



83570°—14——24

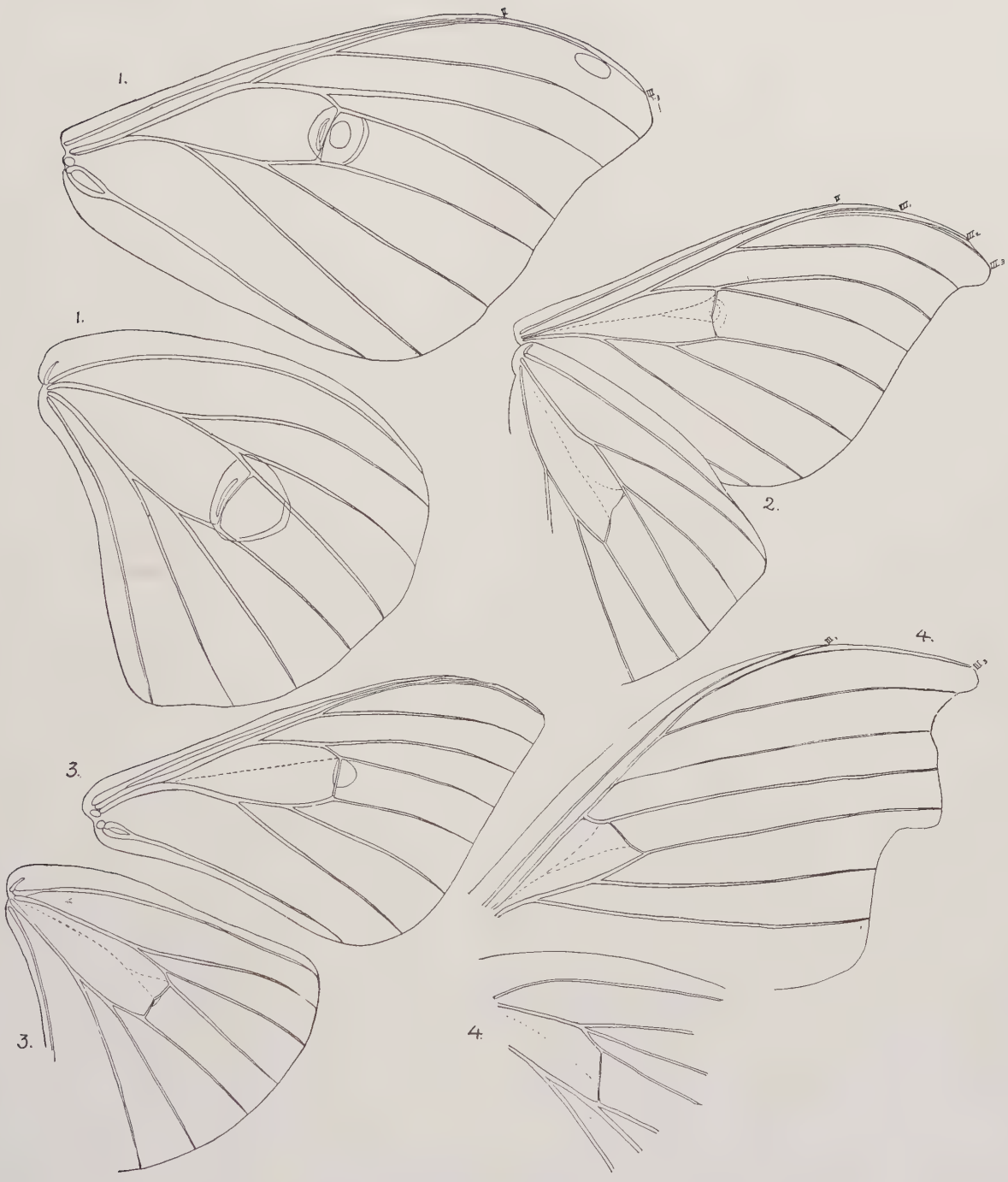
PLATE XLI.

FIG. 1.—*Caligula simla* (Westwood). ♀. [North India.] Anterior wing; no discal folds. Hind wing; no discal veins.

FIG. 2.—*Tagoropsis flavinata* (Walker). ♂. Zanzibar. United States National Museum.

FIG. 3.—*Syntherata insignis* (Walker). ♀. [Australia.] [Probably a form of *S. janetta* (White).]

FIG. 4.—*Teratopteris angulata* (Cramer). ♂. Small one;=*Draconipteris mirabilis* (Stoll). Can not see III_2; there may be one?


1.
1.
2.
3.
3.
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4.

PLATE XLII.

FIG. 1.—*Caligula japonica* Butler. Larva; stage I. 1a, from first thoracic segment; 1b, from second thoracic segment; 1c, from third thoracic segment.

FIG. 2.—*Caligula japonica*. Larva; stage II. Suranal plate. The same armature in later stages.

FIG. 3.—*Caligula japonica*. Larva; stage II. Tubercle. The same in later stages.

FIG. 4.—*Caligula japonica*. Imago; tibial spurs. They are three-quarters as long as tibia.

FIG. 5.—*Imbrasia dorcas* (Walker). Upper wing of male; hind wings of both sexes. [West Africa.]

FIG. 6.—*Molippa sabina* Walker. ♂. Jalapa.

FIG. 7.—*Saturnia* [*Agapema*] *galbina* Clemens. ♀. From a specimen in the Hy. Edwards collection, Amer. Mus. Nat. History. In hind wing II not drawn; wing was folded over.

FIG. 8.—*Saturnia* [*Calosaturnia*] *mendocino* Behrens. ♀. Anterior wing with only one branch of III.

5.
1c.
1a.
1b.
2.
♂
5.
♀
4.
♂ ♀ ♀
7.
3.
6.
7.
6.
8.
8.

PLATE XLIII.

Fig. 1.—*Actias artemis* (Brem.). ♀. Japan. 1a, from the other upper wing; 1b, hind wing of male, not scalloped; 1c, hind wing of female, scalloped. The venation shows plainly that *artemis* is an *Actias*, congeneric with *A. selene*. [Rothschild makes it a subspecies of *selene*.]

Fig. 2.—*Argema leto* (Doubl.). Eastern Asia (Swinhoe). II_1 wanting.

Fig. 3.—*Graellsia isabellæ* (Graells). Hind wing of male.

Fig. 4.—*Graellsia isabellæ*. ♀.

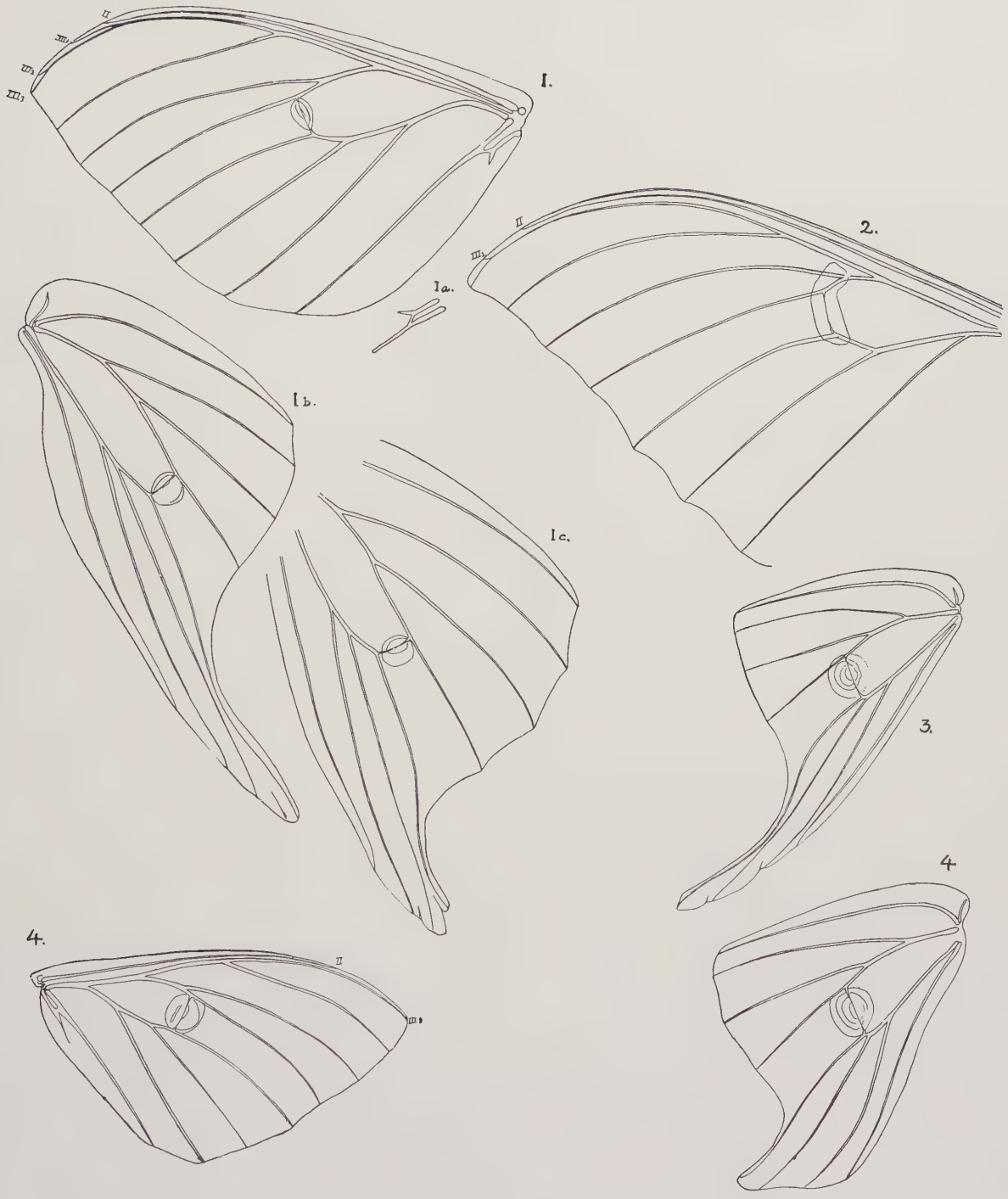

II
III1
III2
III3
1.
1a.
1b.
1c.
2.
II
III1
3.
4.
4.
II
III1

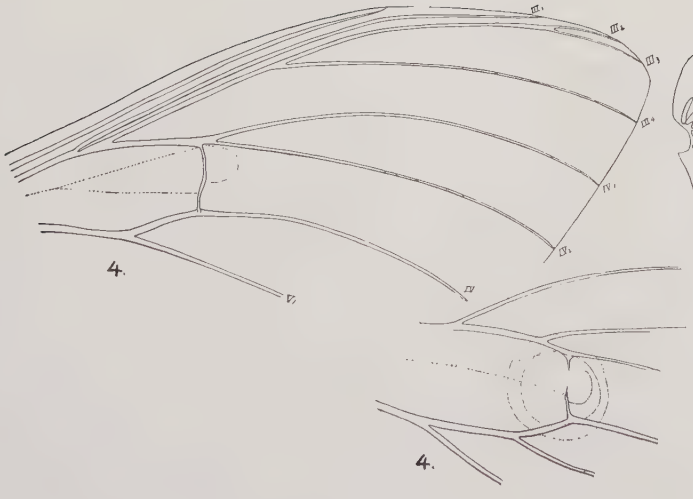
PLATE XLIV.

Fig. 1.—*Epiphora bauhiniae* (Guér.). ♀. [West Africa.] 1a, apex of anterior wing; ♂ is the same.
Fig. 2.—*Epiphora mythimnia* (Westwood). ♂. [South Africa.]
Fig. 3.—*Lobobunaea phaedusa* (Drury). ♂. Hind wing represents underside.
Fig. 4.—*Gonimbrasia alopia* (Westwood). ♀.

1.

1a.
2.
2.

3.


4.
4.

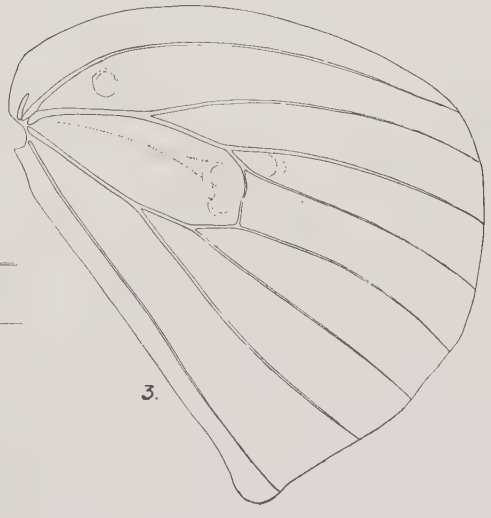

3.

PLATE XLV.

FIG. 1.—*Rothschildia betis* (Walker). ♂. [Brazil].
FIG. 2.—*Rothschildia jacobaeæ* (Walker). Small one. Rio Grande.
FIG. 3.—*Rothschildia splendida* (Beauv.). ♂. Given to Dr. Morris by Clemens; now in Museum of Comparative Zoology.
FIG. 4.—*Rothschildia splendida*. ♀. Brazil (Donckier).
FIG. 5.—*Rothschildia orizaba* (Westwood). ♀. [Mexico to Panama.]

I.
1.
2.
3.
3.
5.
4.
4.
4.

PLATE XLVI.

Fig. 1.—*Attacus edwardsii* White. ♀. 1a, 1b, fore wing; 1c, part of hind wing, with vitreous spot.
Fig. 2.—*Attacus crameri* Felder. ♂. 2a, 2b, fore wing; 2c, hind wing.
Fig. 3.—*Attacus atlas* (Linné). ♂.
Fig. 4.—*Rothschildia aricia* (Walker). ♂.
Fig. 5.—*Rothschildia hesperus* (Linné). ♂. III_2 wanting.
Fig. 6.—*Rothschildia lebeaui* (Guér.). ♂.
Fig. 7.—*Rothschildia betis* (Walker). ♂. Hind wing.

1a
1b
1c
2a
2b
2c
3
3.
4.
5.
6.
7.

PLATE XLVII.

Fig. 1.—*Antheraea paphia* (Linné). ♂.

Fig. 2.—*Nudaurelia anthina* (Karsch)=*preussii* (Staudinger). ♂.

Fig. 3.—[*Nudaurelia*] *antigone* (Staudinger). ♂. near *N. anthina*.

Fig. 4.—*Antheraea yama-mai* (Guér.). Larva. Stage II? (Length 19 mm.) 4a, median tubercle of eighth abdominal segment; 4b, tubercle of suranal plate; 4c, dorsal tubercle of ninth abdominal segment; 4d, from eighth abdominal segment; 4e, infrastigmatal tubercle; 4f, first subdorsal.

Fig. 5.—*Antheraea yama-mai*. Larva. Stage I. 5a, scattered tubercles; no decided barbs; 5b, third thoracic dorsal tubercle; 5c, second thoracic dorsal; higher than third.

Fig. 6.—*Antheraea yama-mai*. Larva. 6a, first dorsal tubercle; 6b, ninth dorsal.

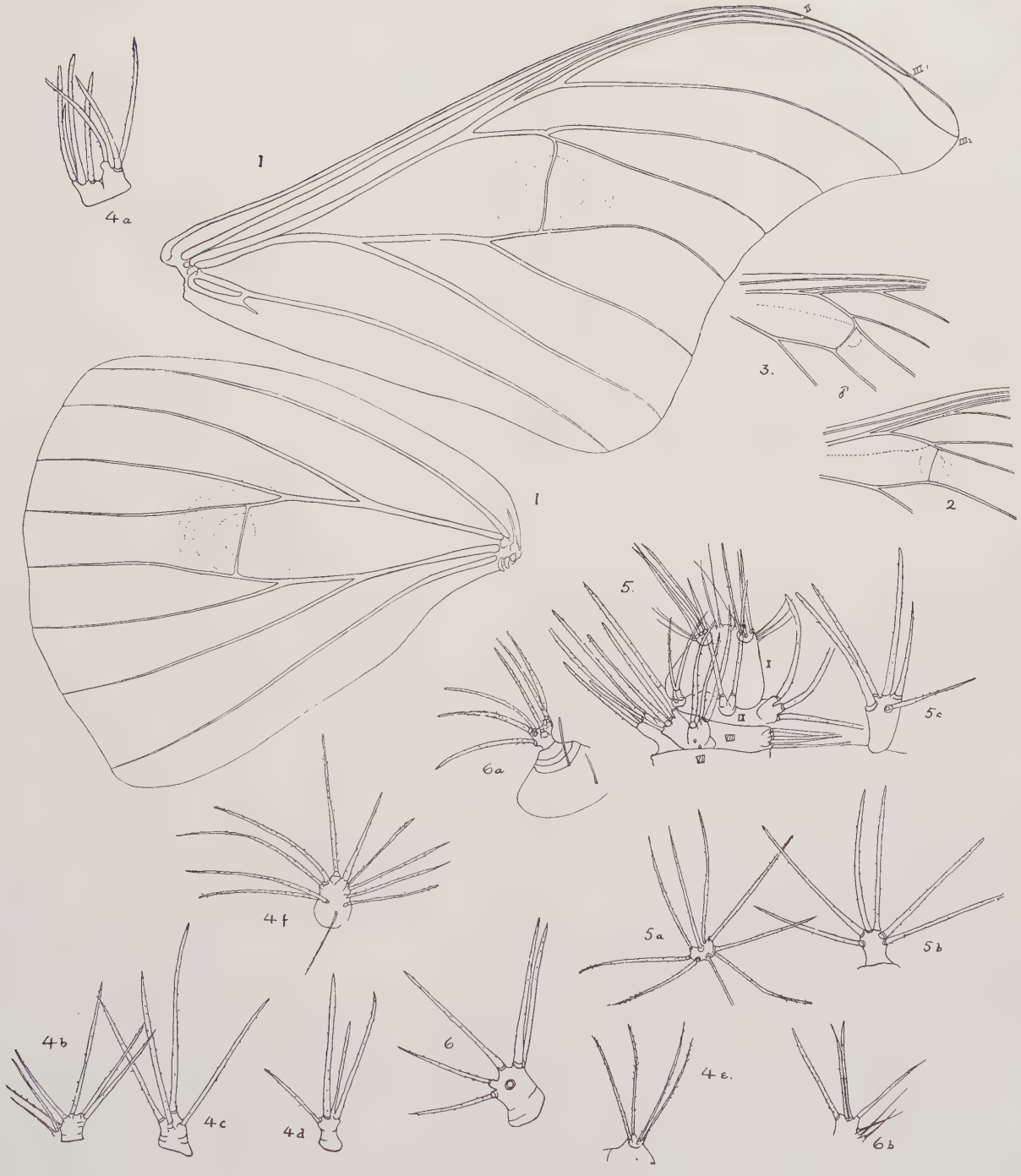

4a
1
II
III'
III
3.
♂
2
1
5.
I
II
VII
VI
5c
6a
4f
5a
5b
4b
4c
4d
6
4e.
6b

PLATE XLVIII.

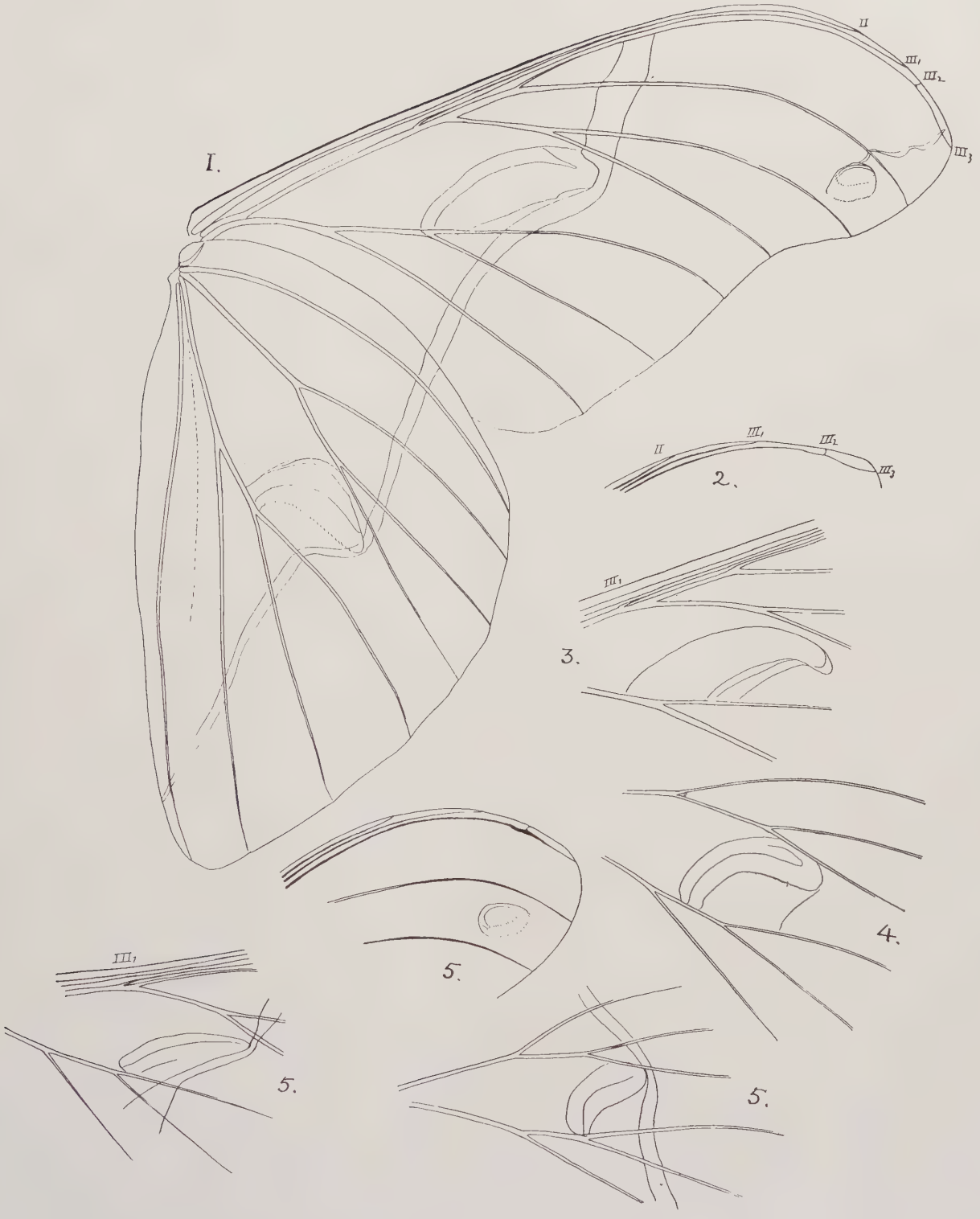
FIG. 1.—*Philosamia cynthia* Auctt. ♂. Raised in Brooklyn, N. Y. Vein III_1 small and nearly atrophied on basal half, becoming beyond the middle larger and better developed (a sign of degeneration and having reached last term of specialization).

FIG. 2.—*Philosamia cynthia* Auctt. ♂. Canton, China. Almost identical with New York insect, only III_2 is a little longer and better developed.

FIG. 3.—*Philosamia cynthia* Auctt. ♂. China.

FIG. 4.—*Philosamia cynthia* Auctt. ♂. China. Veins very slender. [*Philosamia cynthia* auctt.=*P. walkeri* (Felder).]

FIG. 5.—*Philosamia ricini* (Hutt.). ♂. [=*P. lunula* (Walk), according to Rothschild.] Assam. *P. ricini* is the more primitive form; venation less atrophied.



83570°—14——25

PLATE XLIX.

FIG. 1.—*Callosamia* [*Eupackardia*] *calleta* (Westwood). ♂. United States National Museum. Is III_1 really wanting?
FIG. 2.—*Callosamia angulifera* (Walker). ♀.
FIG. 3.—*Callosamia promethea* (Drury). ♂.

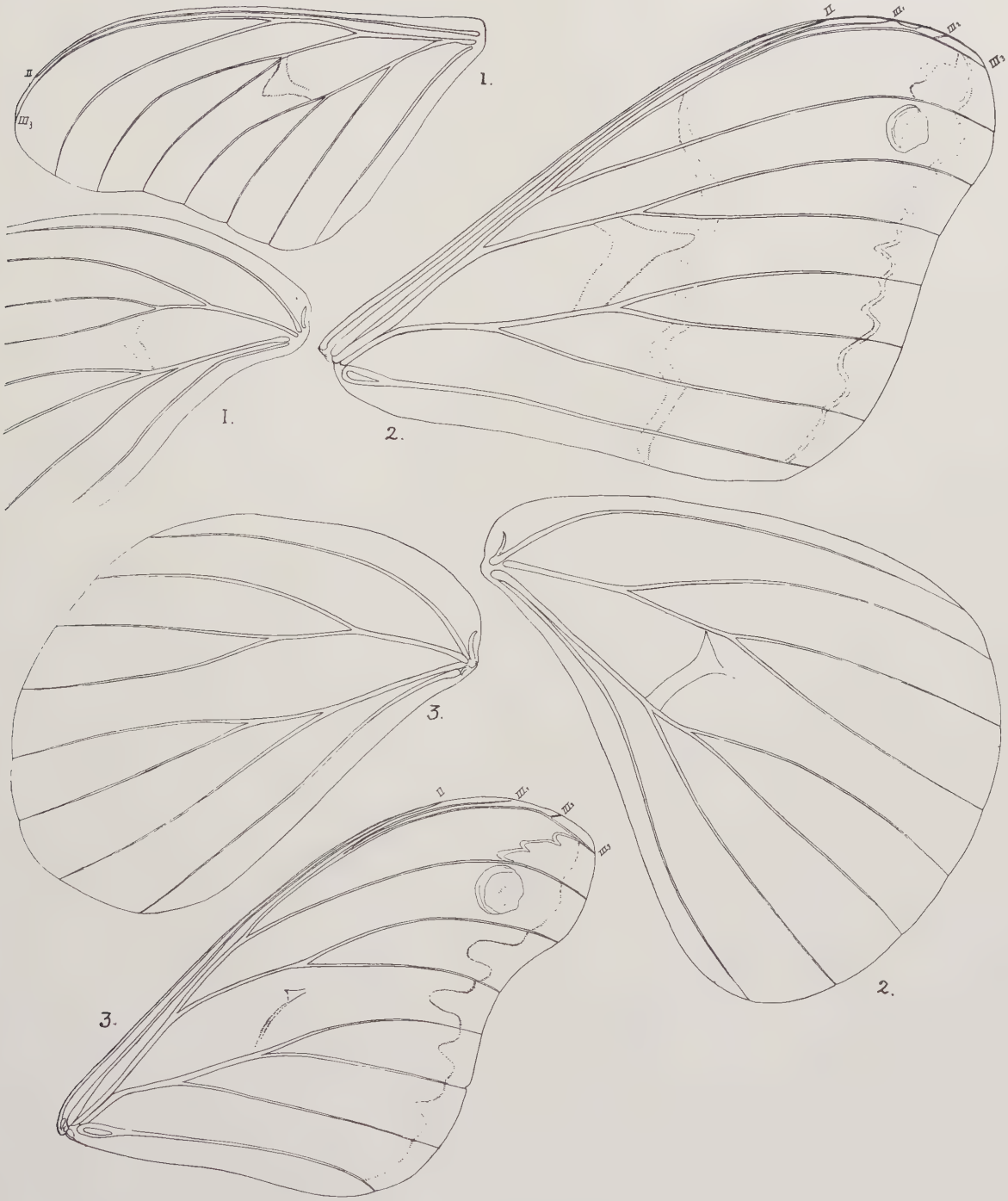

II
III3
1.
I.
II
III1
III2
III3
2.
3.
II
III1
III2
III3
3.
2.

PLATE L.

Fig. 1.—*Telea polyphemus* (Cramer). ♀.

Fig. 2.—*Tropaea truncatipennis* Sonthonnax. ♂. Jalapa. 2a, fore wing; 2b, hind wing; 2c, apex of fore wing (III_2 wanting in both wings in one male; present in other specimen, which is a ♀, fig. 2d.); 2e, tail of hind wing of male.

Fig. 3.—*Tropaea luna* (Linné). ♂. The anterior wing has a slight [anal] fold, not nearly so distinct as in *Actias selene*.

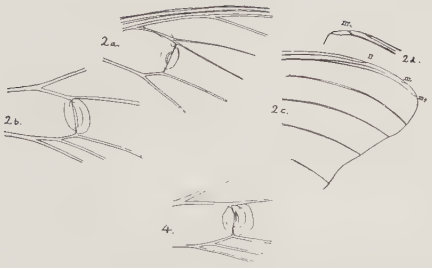
Fig. 4.—*Tropaea luna*. ♂. Eastern Italy. Detail of hind wing.

Fig. 5.—*Actias artemis* (Brem.). ♂. Yokohama, Japan. [Base of radius should be straight.]

Fig. 6.—*Actias selene* (Hübner). ♂. North China. British Museum.

Fig. 7.—*Actias selene*. Large example. ♂. Masuri, N. W. Himalaya (Hutton). British Museum. III_2 five to six times longer than in complete figure (♂, North China). In Grote's figure II ends far within the fork of III. In *A. selene* ♂ from Silhet II ends still farther beyond the fork of III, and in ♂ from N. W. Himalaya II ends half-way between fork and III_1. In ♀ from China it ends as in figure. In small ♂ from North China it ends as in figure, but a little farther toward apex from fork. The Indian form is a climatic variety.

Fig. 8.—*Actias* [*Argema*] *moenas* Doubleday. ♀.

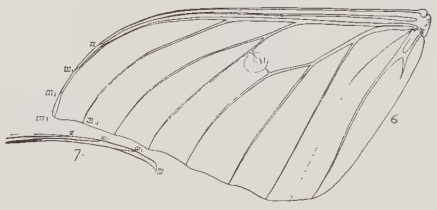

2a.
2b.
2c.
2d.
4.

1

3
5
5.

1

3
2e.


6
7

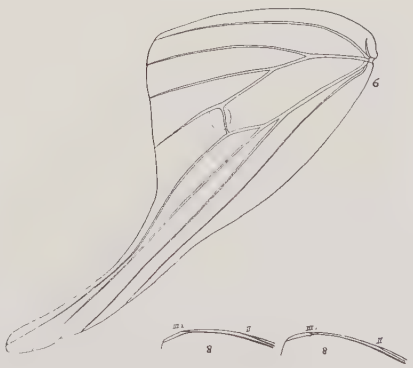

6

PLATE LI.

FIG. 1.—*Samia gloveri* (Strecker). ♀. Fore wing with no III_2; carefully reexamined. No traces of discal veins.

FIG. 2.—*Samia columbia* Smith. ♀. Fore wing with II and III close together. No III_2. III_3 partly obsolete. Hind wing with doubtful vestige of vein VI.

FIG. 3.—*Samia cecropia* (Linné). ♀. In anterior wing, origin of III_3 is much nearer base of wing than III_5, while in *columbia* and *gloveri* it is beyond origin of III_5. No III_2. Antenna of same ♀ was deformed.

FIG. 4.—*Samia cecropia*. ♂. Detail of end of anterior wing.

FIG. 5.—*Samia californica* (Grote). ♀.

FIG. 6.—*Metosamia godmani* Druce. ♂.

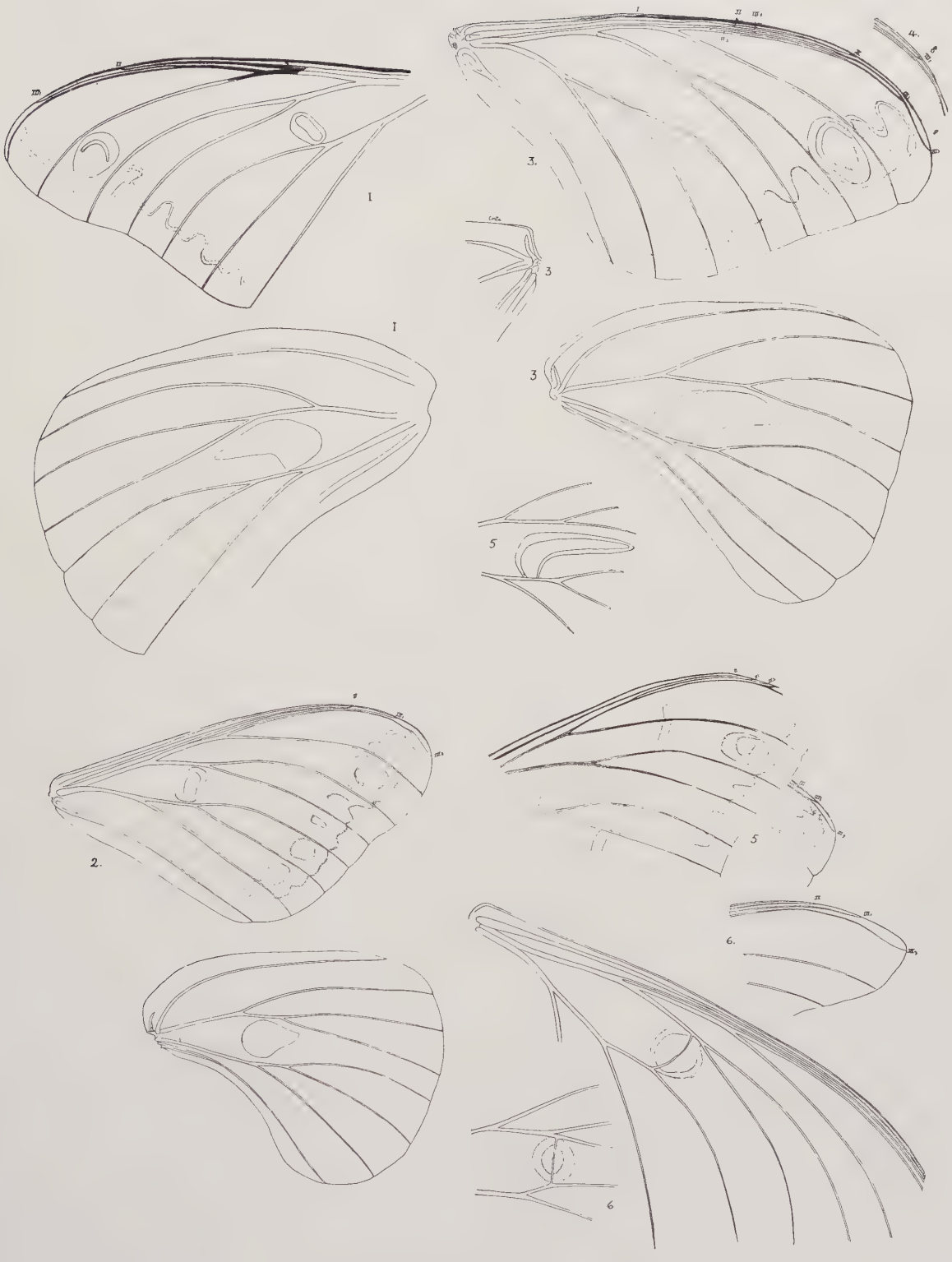

1
1
3.
3
3
5
2.
5
6.
6

PLATE LII.

FIG. 1.—*Hemileuca maia* (Drury). ♂.
FIG. 2.—*Hemileuca maia*. ♀. Head; from dried specimen.
FIG. 3.—*Hemileuca artemis* Packard. ♀. Las Cruces [New Mexico].
FIG. 4.—*Hemileuca artemis*. Details of pupa. A well marked cremaster; a few short setæ at tip, 2 to 3 on each side.
FIG. 5.—*Hemileuca nevadensis* Stretch. California.
FIG. 6.—*Hemileuca juno yavapai* (Neum.). ♀. 6a, fore wing; 6b, hind wing.
FIG. 7.—*Hemileuca* [*Meroleuca*] *venosa* Walker. ♂. Bogota, Caracas, and Colombia. The intradiscal vein *very* faint.
FIG. 8.—*Euleucophaeus* [*oliviæ* (Cockerell)]. Cimarron River, northern New Mexico.
FIG. 9.—*Euleucophaeus* [*packardi* n. sp.]. ♀. Tacubaya (Barrett). All pink, with two white lines.
FIG. 10.—*Euleucophaeus norba* Druce. ♂. Tacubaya.

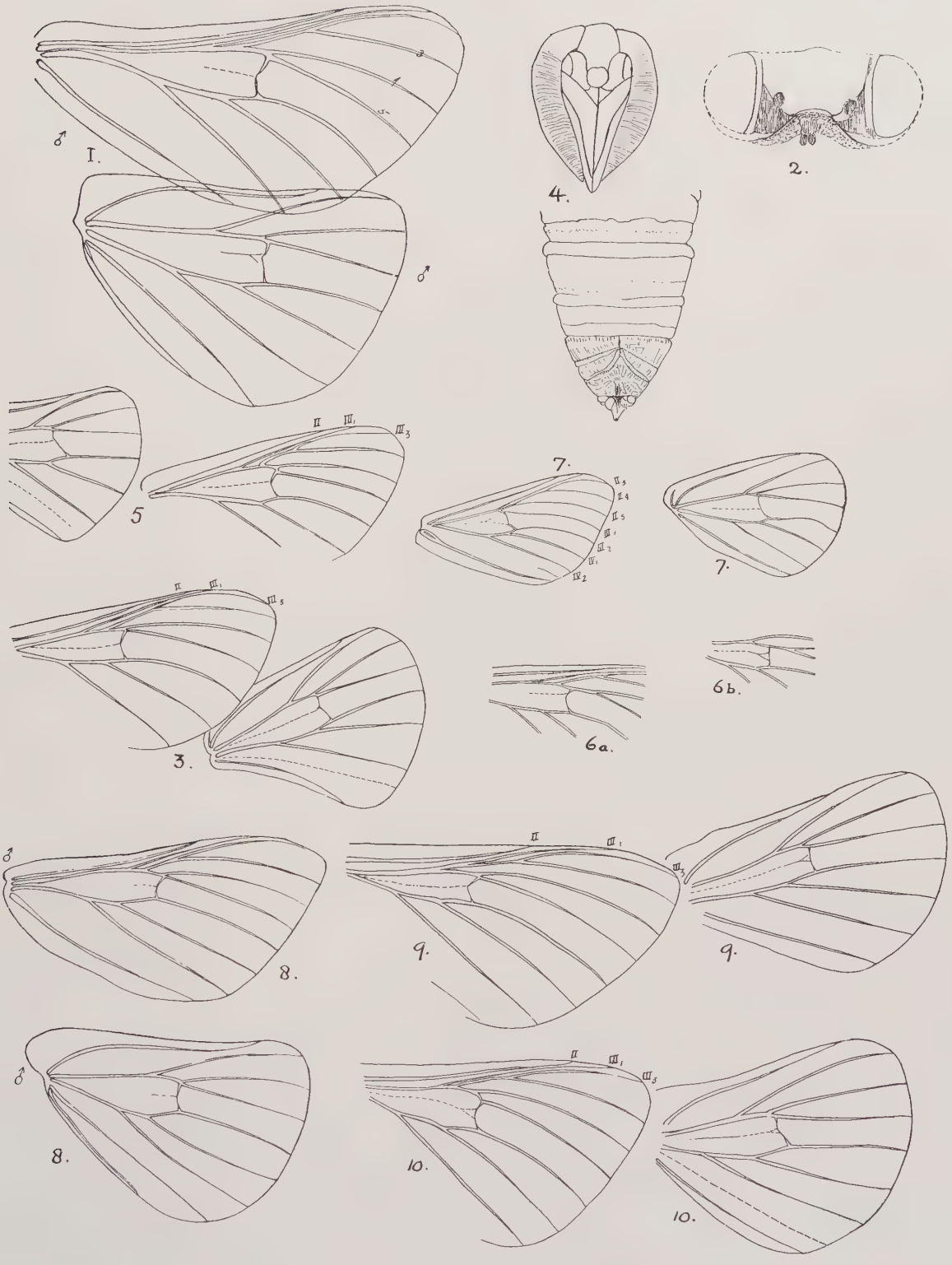

♂
1.
♂
4.
2.
7.
7.
5
II
III1
III3
II5
II4
III5
III1
III2
IV1
IV2
3.
II
III1
III5
6a.
6b.
♂
8.
9.
II
III1
III2
9.
♂
8.
10.
II
III1
III5
10.

PLATE LIII.

Fig. 1.—*Dirphia hoegei* Druce. ♀. Jalapa; Mexico.
Fig. 2.—*Dirphia speciosa* (Cramer). ♀. Ega; Demerara. [*Plateia speciosa* of Kirby's Catalogue.]
Fig. 3.—*Dirphia alanus*. ♀. Chile. 3a, fore wing; 3b, hind wing.
Fig. 4.—*Dirphia semirosea* Walker. ♀. Costa Rica; Mexico. [*Ormiscodes semirosea* of Kirby's Catalogue.]
Fig. 5.—*Rhodormiscodes rosea* (Druce). ♂.
Fig. 6.—*Ormiscodes cinnamomea* (Feisth.). ♂. Chile.
Fig. 7.—*Protautomeris maeonia* (Druce). ♂.
Fig. 8.—*Phricodia agis* (Cramer). ♀. Jalapa.
Fig. 9.—*Hyperdirphia tarquinia* (Cramer). ♂.
Fig. 10.—*Catocephala luperina*. ♀. Chile.

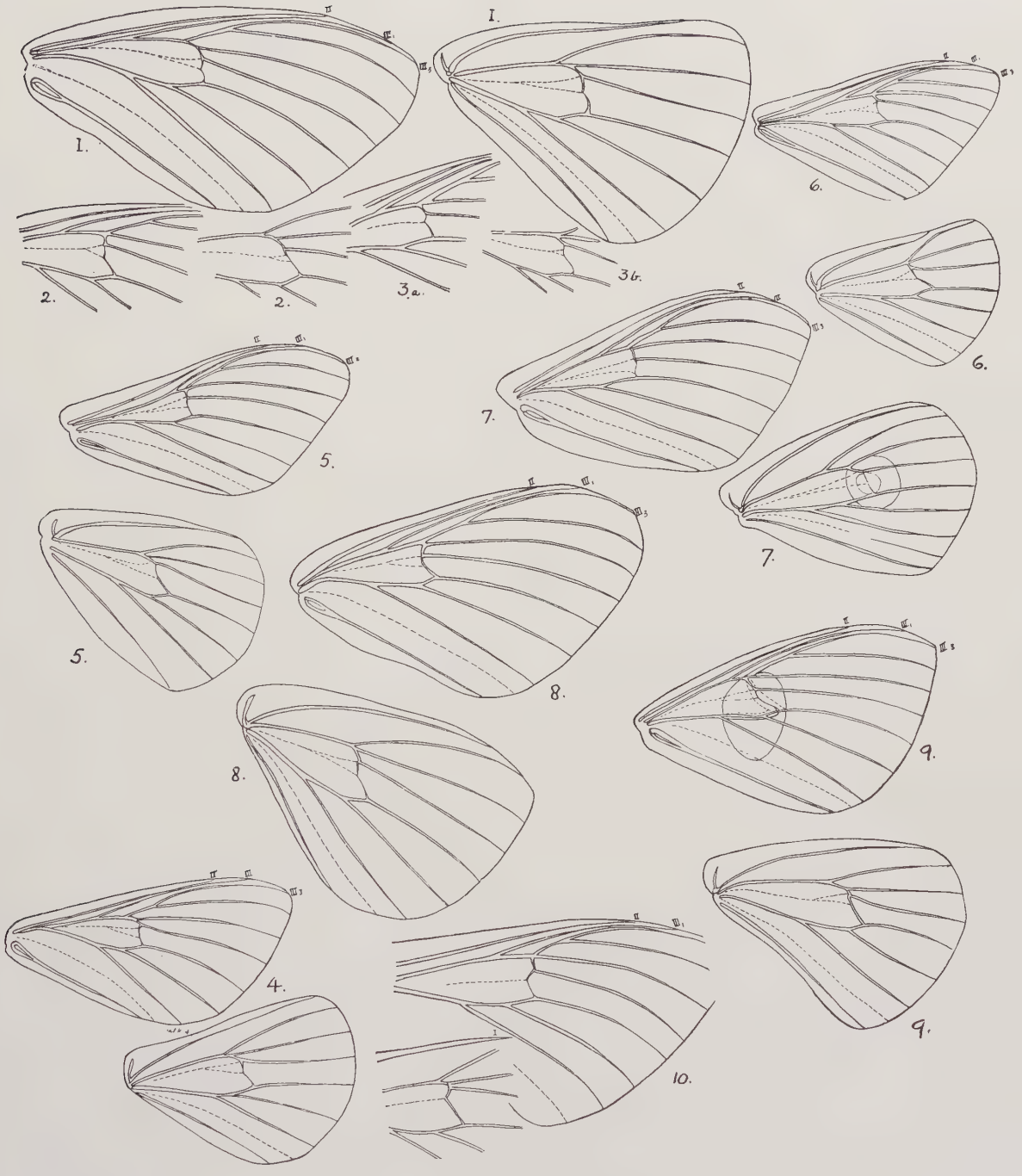

1.
2.
2.
3a.
I.
3b.
6.
6.
7.
7.
5.
5.
8.
8.
9.
9.
4.
10.

PLATE LIV.

Fig. 1.—*Autómeris coresus* (Boisduval). Larva; last stage. Buenos Ayres. Amer. Mus. Nat. History. 1a, median tubercle on eighth abdominal segment; 1b, prothoracic dorsal; 1c, third thoracic dorsal.

Fig. 2.—*Automeris viridescens* (Walker). Larva; third stage? Buenos Ayres. 2a, from prothoracic segment; 2b, second thoracic dorsal; 2c, eighth median abdominal.

Fig. 3.—*Automeris viridescens*. Larva; penultimate stage. 3a, from second dorsal segment; 3b, median tubercle of eighth abdominal segment.

Fig. 4.—*Hyperchiria varia* Walker. [Generally considered a synonym of *Automeris io*.] From a dried specimen. Details of head and wings.

Fig. 5.—*Automeris io* (Fabricius). ♂.

Fig. 6.—*Coloradia pandora* Blake. ♂. California.

Fig. 7.—*Coloradia* (*Eudyaria*) *venata* (Butler). ♀. Buenos Ayres. 7a, hind wing.

Fig. 8.—*Coloradia* (*Eudyaria*) *venata*. Larva; last stage. Tubercles: 8a, prothoracic dorsal; 8b, third thoracic dorsal; 8c, median on eighth abdominal segment, bilaterally symmetrical.

1a.
1b.
1c.
2a.
2b.
2c.
3a.
3b.
4.
5.
6.
7.
7a.
8a.
8b.
8c.

PLATE LV.

Samia cecropia. ♂. Washington, D. C., June 8, 1908.
Samia cecropia. ♀. Washington, D. C., issued May 19, 1898.
Both in United States National Museum.—H. G. Dyar.

SAMIA CECROPIA.

PLATE LVI.

TELEA POLYPHEMUS.

FIG. 1.—♂. Washington, D. C., May 25, 1887.
FIG. 2.—♀. Schaus collection. New York.

TELEA POLYPHEMUS.

Mexican race (without the pale suffusion beyond submarginal band).

FIG. 3.—♂. Jalapa, Mexico. (W. Schaus.)
FIG. 4.—♀. Orizaba, Mexico. (W. Schaus.)
All in United States National Museum.—H. G. DYAR.

S&S'D° -14- °02SS

TELEA POLYPHEMUS.

PLATE LVII.

ROTHSCHILDIA JORULLA (Westw.).

FIG. 1.—♂. "Mexico," Dept. Agr., No. 7009, issued June 6, 1897. [7009 was bred from a cocoon sent by Dr. B. F. G. Egeling from Monterey, Mexico.]

FIG. 2.—♀. "Arizona," type of *Attacus cinctus* Tepper. Type No. 1414, United States National Museum.

PHILOSAMIA CYNTHIA Auctt. (=WALKERI).

Philosamia "cynthia." [See Hampson, Moths of India, I, 16. He includes under "*cynthia*," "Typical *cynthia* from Java is the palest form, with the pinkish-white suffusion beyond the postmedial band of both wings, which is nearly straight, diffused along the veins; *walkeri=canningii=vesta*, from China and India is darker fulvous, with the postmedial band curved and the suffusion beyond more restricted; while *pryeri* from Japan is again considerably darker." Evidently ours was introduced from China and there has been *no* "American race" developed.—H. G. D.]

FIG. 3.—♀. Washington, D. C., issued June 8, 1895.

FIG. 4.—♂. Philadelphia, Pa., issued May 18, 1889. (H. G. Dyar.)

All in the United States National Museum.—H. G. DYAR.

ROTHSCHILDIA JORULLA AND PHILOSAMIA WALKERI.

PLATE LVIII.

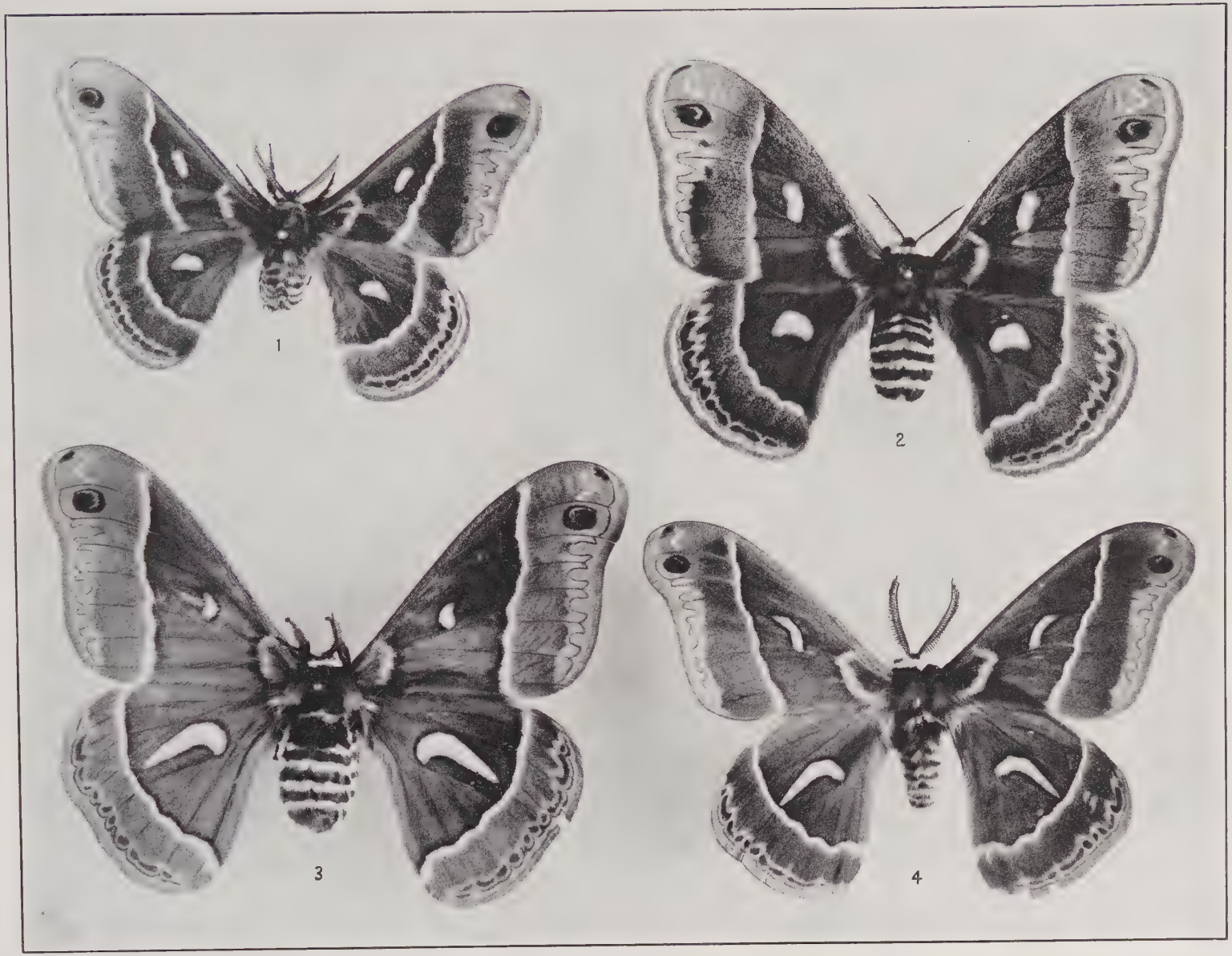
SAMIA COLUMBIA Sm.

FIG. 1.—♂. Orono, Me. (Collection of O. Meske.)
FIG. 2.—♀. Michigan, issued June 13, 1893. (R. A. Wolcott.)

SAMIA RUBRA Behr.

FIG. 3.—♀. Sierra Nevada, Cal. (F. Burns.)
FIG. 4.—♂. California (Schaus collection).

All in United States National Museum.—H. G. DYAR.



SAMIA COLUMBIA AND SAMIA RUBRA.

PLATE LIX.

AGAPEMA HOMOGENA Dyar.

FIG. 1.—♂ type, Mexico City, Mexico. March, 1908. (R. Müller.)
FIG. 2.—♀ type, Fly Park, Chiricahua Mountains, Ariz., 10,000 feet, June 9, 1894. Type No. 11871, United States National Museum.

AGAPEMA GALBINA (Clem.).

FIG. 3.—♂. "Esper. Rch.," Brownsville, Tex. (J. Doll.)
FIG. 4.—♀. "Esper. Rch.," Brownsville, Tex. (J. Doll.)

AGAPEMA ANONA (Ottol.).

FIG. 5.—♂. Chihuahua, Mexico. (Schaus collection.)
FIG. 6.—♀. Chihuahua, Mexico. (Schaus collection.)

HYPERCHIRIA ZEPHYRIA Grt.

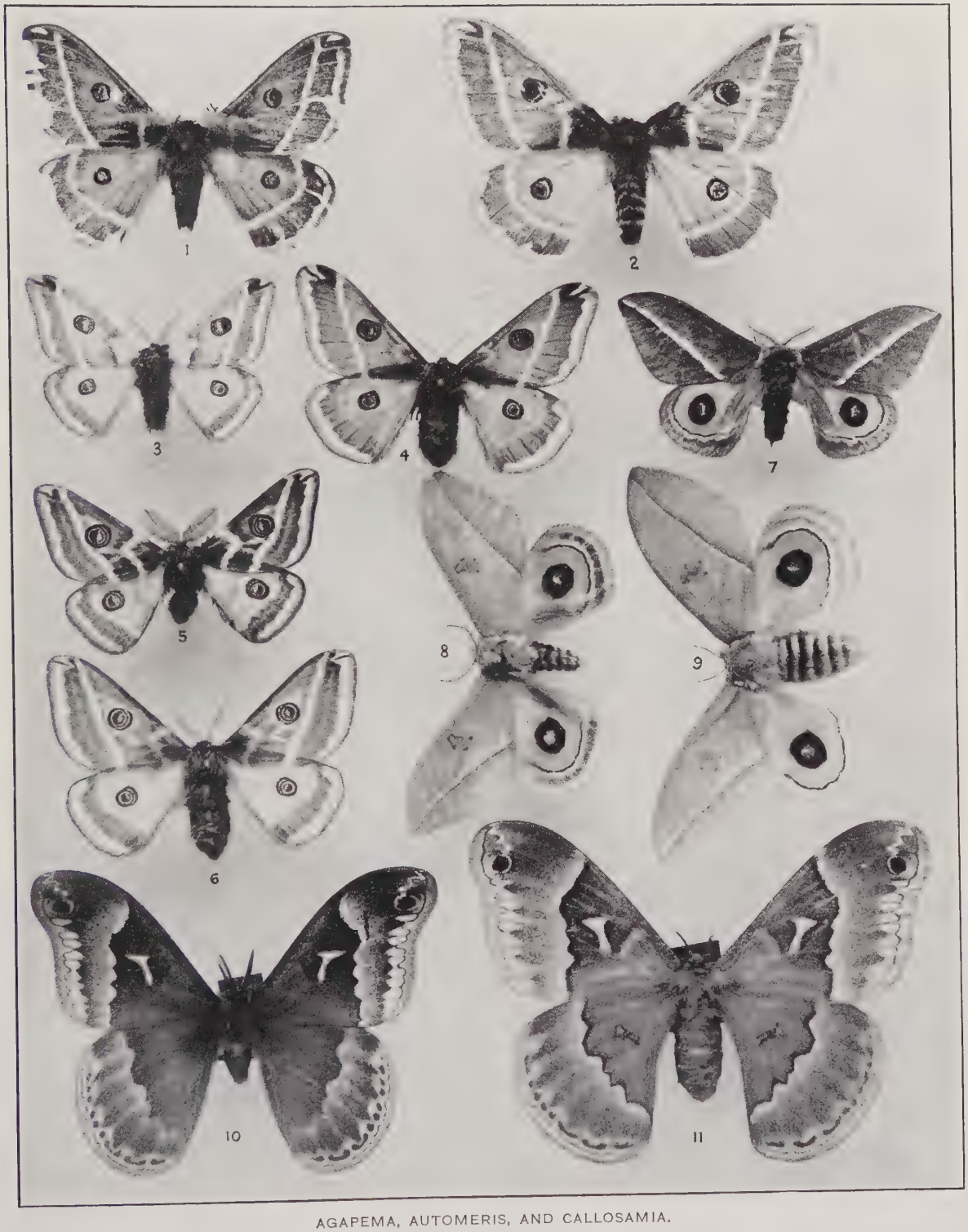
FIG. 7.—♂. Near Hot Springs, Las Vegas, N. Mex., 7,000 feet, July, 1882. (F. H. Snow.)

HYPERCHIRIA PAMINA Neum.

FIG. 8.—♂. Chiricahua Mountains, Ariz., June 26. (H. G. Hubbard.)
FIG. 9.—♀. Arizona, purchase from J. Doll. (H. G. Dyar.)

CALLOSAMIA ANGULIFERA CAROLINA Jones.

FIG. 10.—♂. Cotype, Berkeley County, S. C., April, 1908. (F. M. Jones.)
FIG. 11.—♀. Cotype, Berkeley County, S. C., April, 1908. (F. M. Jones.)
All in United States National Museum.—H. G. DYAR.



AGAPEMA, AUTOMERIS, AND CALLOSAMIA.

PLATE LX.

HYPERCHIRIA IO (Fab.).

FIGS. 1, 2.—♂, ♀, cotypes, var. *fusca* Luther, Providence, R. I., February 2, 1907. (C. H. Luther.) [The ordinary North Atlantic form.]

FIG. 3.—♂. Tryon, N. C., August 3, 1904. (W. F. Fiske.)

FIG. 4.—♀. (Collection of G. Beyer.) [The southern Atlantic form, probably *H. io io* Fab.]

H. IO LILITH Strecker.

FIG. 5.—♂. Miami, Fla. (Schaus collection.)

FIG. 6.—♀. Florida. (Schaus collection.)

HEMILEUCA NEUMOEGENI BURNSI (Watson).

FIGS. 7, 8.—♂, ♀, bred by Watson from pupæ from Burns. Truckee Pass, Cal., 7,000 feet.

HEMILEUCA OLIVIÆ Cockerell.

FIG. 9.—♂ type, Santa Fé., N. Mex., fall of 1897. (T. D. A. Cockerell.) Type No. 4111, United States National Museum.

HEMILEUCA LUCINA Edwards.

FIGS. 10, 11.—♂, ♀, "metatypes." Raymond, N. H. Bred September, 1909. (W. Reiff.) Labeled by him "trans. ad ab. *obsoleta* Reiff." [This must be a good species, as it has a different food plant from *maia*.]

HEMILEUCA MAIA (Dru.).

FIG. 12.—♀. Riley's notes 9 L., September 23. [Bred by Lugger; locality not given.]

FIG. 13.—♂. No. 934, Department of Agriculture; issued September 21, 1881. [Bred by Pergande from larvæ found on *Salix viminalis* by Dr. W. J. Conklin, of Dayton, Ohio.]

HEMILEUCA NEVADENSIS ARTEMIS Packard.

FIG. 14.—♂. No. 5763, Department of Agriculture; issued October 27, 1894. [Las Cruces, N. Mex. Bred from larvæ sent by T. D. A. Cockerell.]

FIG. 15.—♀. No. 5763, Department of Agriculture; issued November 2, 1894. [Las Cruces, N. Mex. Bred from larvæ sent by T. D. A. Cockerell.]

All in United States National Museum.—H. G. DYAR.

AUTOMERIS AND HEMILENCA.

PLATE LXI.

COLORADIA PANDORA Blake.

FIGS. 1, 2.—♂, ♀. Colorado. (Schaus collection.)

C. LOIPERDA Dyar.

FIGS. 3, 4.—♂, ♀. Glenwood Springs, Colo. (W. Barnes.) Types.

C. DORIS Barnes (=LOIS Dyar).

FIGS. 5, 6.—♂, ♀. Miles City, Mont. (C. A. Wiley.) ♂ June 16, 1890; ♀ June 11, 1891. Types of *lois*.

HEMILEUCA MARILLIA Dyar.

FIG. 7.—♂. Orizaba, Mexico, November, 1911. (R. Müller.)
FIG. 8.—♀. Tehuacan, Mexico, September, 1908. (R. Müller.) Type ♀.

HYLESIA CRESSIDA Dyar.

FIG. 9.—♀. Jalapa, Mexico. (Schaus collection.) Labeled by Schaus *alinda*.
FIG. 10.—♂. From Mr. Schaus's duplicates, probably Jalapa, Mexico.
All in National Museum.—H. G. DYAR.

COLORADIA DORIS Barnes.

FIGS. 11, 12.—*Coloradia doris*. Types, ♂ and ♀. In Barnes collection (McDunnough photograph).

COLORADIA, HEMILEUCA, AND HYLESIA.

PLATE LXII.

FIG. 1.—♂. *Pseudohazis eglanterina* Bd., labeled by Neumoegen. (Collection of Schaus.)
FIG. 2.—♀. *Pseudohazis eglanterina* Bd., Pullman, Wash., reared from larva on *Symphoricarpus*. (C. V. Piper.)
FIG. 3.—♀. *P. shastaensis*, California. (Collection of Dyar.)
FIG. 4.—*P. shastaensis denudata*, Fort Klamath, Oreg. (Collection of Schaus.)
FIG. 5.—*P. shastaensis denudata*, Fort Klamath, Oreg. (Collection of Schaus.)
FIG. 6.—*P. shastaensis*. ♂. Shasta County, Cal., July, 1904. (F. X. Williams.)
FIG. 7.—*P. shastaensis* (melanic form originally intended by the name), Fort Klamath, Oreg. (Collection of Schaus.)
FIG. 8.—*P. hera marcata*, labeled by Neumoegen. (Collection of Schaus.)
FIG. 9.—♀. *P. hera* Harr., Davis Creek, Cal., July 10, 1897. (Mrs. R. M. Austin.)
FIG. 10.—*Hemileuca electra* Wright. ♂. San Diego, Cal., November 20, 1906. (G. H. Field.)
FIG. 11.—*Hemileuca electra* Wright. ♀. San Diego, Cal.; labeled by Neumoegen. (Collection of Schaus.)
FIG. 12.—*Hemileuca minette* Dyar; ♂ type.
FIG. 13.—♂. *Pseudohazis hera*, Colorado. (Bruce.)

All in United States National Museum.—H. G. DYAR.

PSEUDOHAZIS AND HEMILEUCA.

PLATE LXIII.

Fig. 1.—♂, fig. 2 ♀. *Hemileuca grotei.* Chiricahua Mountains, Ariz., August 29.. Photograph by (?) McDunnough from specimens in collection of Barnes.

Fig. 3.—♂, fig. 4 ♀. *Hemileuca juno.* Male, Yavapai County, Ariz.; female, Gila County, Ariz. Photograph by McDunnough from collection of Barnes.

Fig. 5.—♂. *Hemileuca neumoegeni.* Yavapai County, Ariz. (Buchholz.) Photograph by McDunnough from collection of Barnes.

Fig. 6.—♂, fig. 7 ♀. *Hemileuca burnsi.* Male, Esmeralda County, Nev. (Owen); female, Truckee Pass, Cal., from original type lot. Photograph by McDunnough from collection of Barnes.

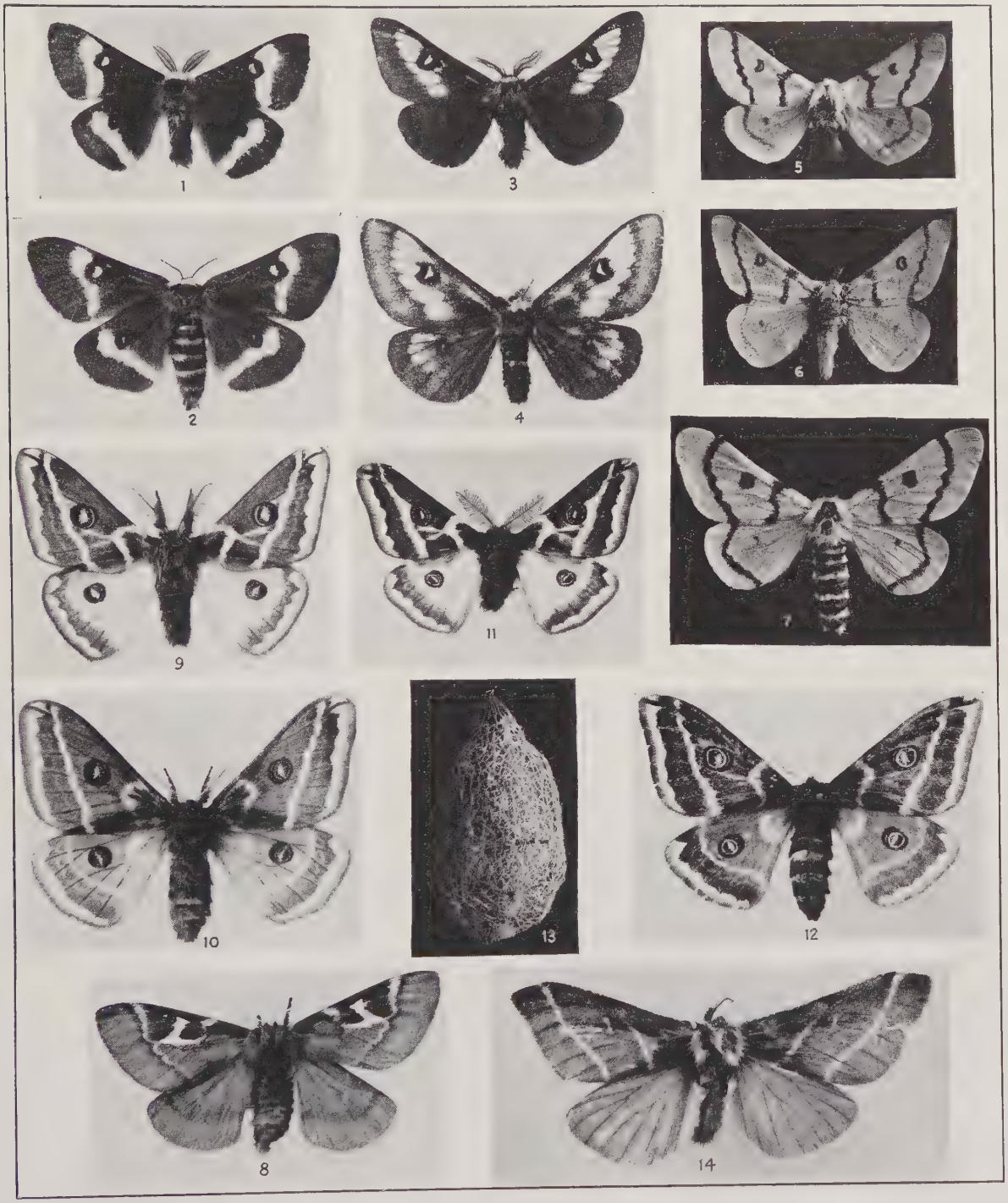
Fig. 8.—*Thauma socialis.* ♀. (Type of *T. ribis.*) American Museum of Natural History.

Fig. 9.—♂, fig. 10 ♀. *Agapema anona.* Redington, Ariz. Photograph by McDunnough from collection of Barnes.

Fig. 11.—♂, fig. 12 ♀. *Agapema anona.* American Museum of Natural History.

Fig. 13.—Cocoon of *Agapema anona.* Redington, Ariz. Photograph by McDunnough from collection of Barnes.

Fig. 14.—*Hemileuca sororia,* female. Type. American Museum of Natural History.



HEMILEUCA, AGAPEMA, AND THAUMA.

PLATE LXIV.

Fig. 1.—*Rothschildia amazonia* (Packard). From type (Museum of Comparative Zoology).

Fig. 2.—*Rothschildia orizaba* (Westwood), variety of male? Photograph from Miss C. G. Soule. This had been identified as *R. splendida*.

Fig. 1.

Fig. 2.

ROTHSCHILDIA AMAZONIA AND R. ORIZABA, VARIETY.

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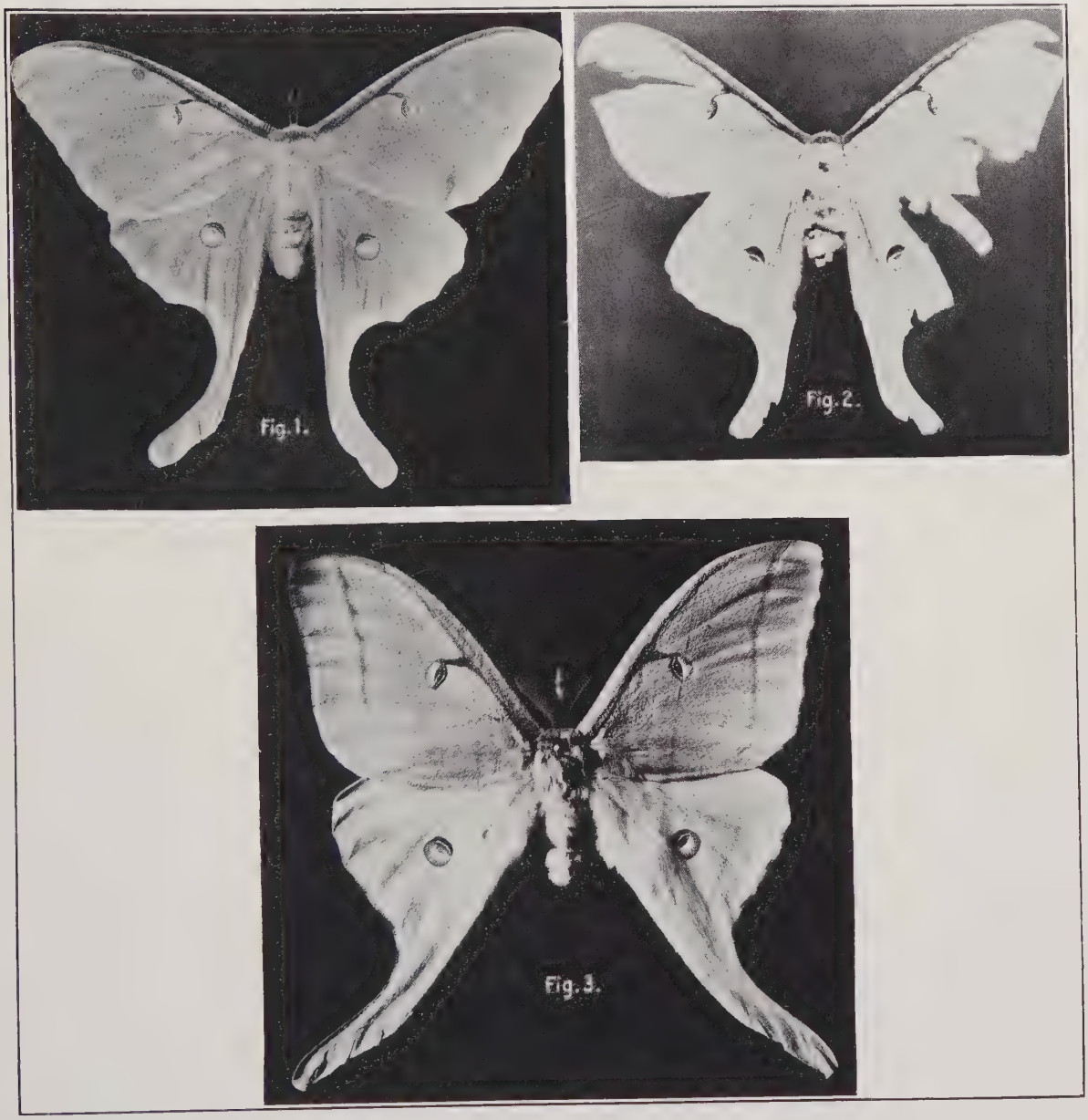
PLATE LXV.

FIG. 1.—*Tropaea luna*. Miss Soule photograph.
FIG. 2.—*Tropaea azteca*.
FIG. 3.—Labeled *T. azteca*, but evidently *dictynna*. From Museum of Comparative Zoology.



TROPAEA LUNA, T. AZTECA, AND T. DICTYNNA.

PLATE LXVI.

FIGS. 1, 2.—*Telea polyphemus oculea* Neum. Male from Prescott, Ariz.; female from Milow Ranch, Prescott, Ariz., June. The female is the type of *oculea*.

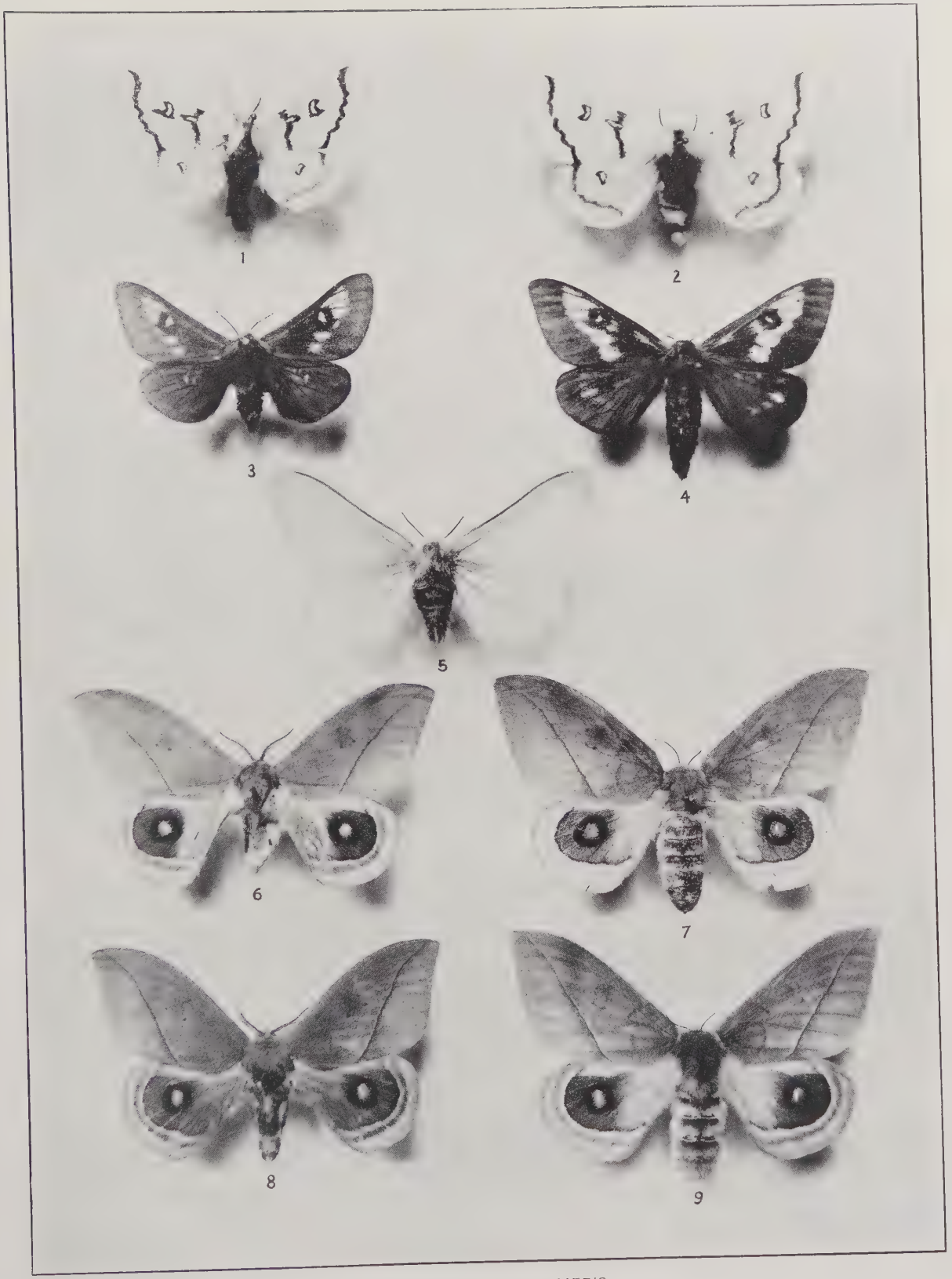
FIGS. 3, 4.—*Samia gloveri reducta* Neum. Types, female and male, Gibson Gulch, Park County, Colo., 11,000 feet altitude.

All in Museum of Brooklyn Institute of Arts and Sciences.

TELEA AND SAMIA.

PLATE LXVII.

FIGS. 1, 2.—*Hemileuca neumoegenii* Hy. Edwards. Types, male and female. Milow Ranch, Prescott, Ariz., July.
FIGS. 3, 4.—*Hemileuca yavapai* Neum. [*juno* Packard]. Types, male and female, of *yavapai*. Tucson, Ariz., September.
FIG. 5.—*Hemileuca hualapai* (Neum.). Type, female. Southwest Arizona.
FIGS. 6, 7.—*Automeris pamina* Neum. Types, male and female. Milow Ranch, Prescott, Ariz., June.
FIGS. 8, 9.—*Automeris pamina aurosea* Neum. Types, male and female. Milow Ranch, Prescott, Ariz., June.
All in Museum of Brooklyn Institute of Arts and Sciences.



HEMILEUCA AND AUTOMERIS.

PLATE LXVIII.

FIGS. 1, 2.—*Automeris zephyria*, ♂ and ♀. New Mexico (F. H. Snow). McDunnough photograph, from collection of Barnes.

FIGS. 3, 4.—*Pseudohazis eglanterina*. ♂ and ♀. American Museum of Natural History.

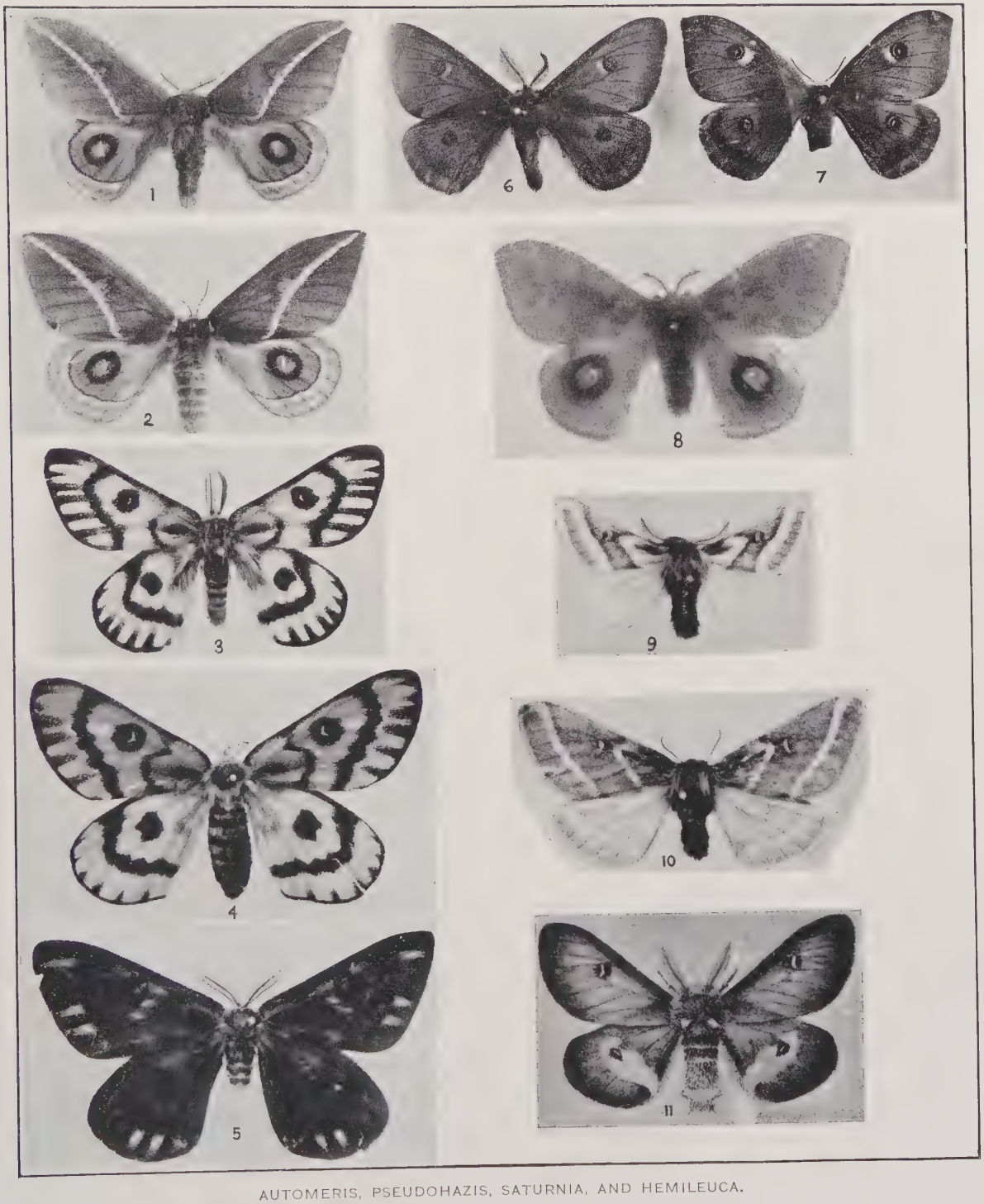
FIG. 5.—*Pseudohazis shastaensis*. ♂. American Museum of Natural History.

FIGS. 6, 7.—*Saturnia mendocino*. ♂ and ♀.

FIG. 8.—*Automeris io*. ♂, variety. From Miss Soule.

FIGS. 9, 10.—*Hemileuca tricolor*. ♂ and ♀.

FIG. 11.—*Hemileuca maia*. ♂, variety. Photograph from Dr. J. A. Lintner. [ab. nov. *lintneri;* fore wings without bands.]



AUTOMERIS, PSEUDOHAZIS, SATURNIA, AND HEMILEUCA.

PLATE LXIX.

FIG. 1.—*Callosamia* [*Eupackardia*] *calleta* (*polyommata* Tepper). ♂. United States National Museum.
FIG. 2.—*Callosamia angulifera*. ♀. Photograph from Miss Soule.
FIGS. 3, 4.—*Callosamia promethea*. ♂ and ♀. Photograph from Miss Soule.

EUPACKARDIA AND CALLOSAMIA.

PLATE LXX.

FIG. 1.—*Callosamia promethea*, just emerged from cocoon.

FIG. 2.—*Samia gloveri*. ♂. Photograph from Miss Soule.

FIG. 3.—*Attacus* [*Rothschildia*] *splendidus* (Beauv.) [*erycina*]. From specimen in Museum of Comparative Zoology, given by Clemens to Morris.

FIG. 4.—*Rothschildia "jorulloides*?, *jorulla*?" ♀. Photograph from Miss Soule. [*R. jorulloides* Dogn. was described in Naturaliste, 1895, p. 142. Miss Soule's insect seems not to differ essentially from *jorulla*.]

CALLOSAMIA, SAMIA, AND ROTHSCHILDIA.

PLATE LXXI.

Hybrid larvæ of *Philosamia cynthia* ♂ × *Callosamia promethea* ♀, described in Psyche, November, 1902. Photographs from Miss C. G. Soule.

Fig. 1.—After first, second, and third molts. Both forms.
Fig. 2.—Both forms after second and third molts; one molting second time.
Fig. 3.—"*promethea* form," after fourth molt.
Fig. 4.—"*cynthia* form," after fourth and fifth molts.

HYBRID LARVÆ, PHILOSAMIA × CALLOSAMIA.

PLATE LXXII.

FIG. 1.—*Lobobunaea phaedusa*. [Type of genus.] From Journ. N. Y. Ent. Soc., Vol. IX, Pl. XII.
FIG. 2.—*Rhescyntis hippodamia*. [Type of genus.]

LOBOBUNÆA AND RHESCYNTIS.

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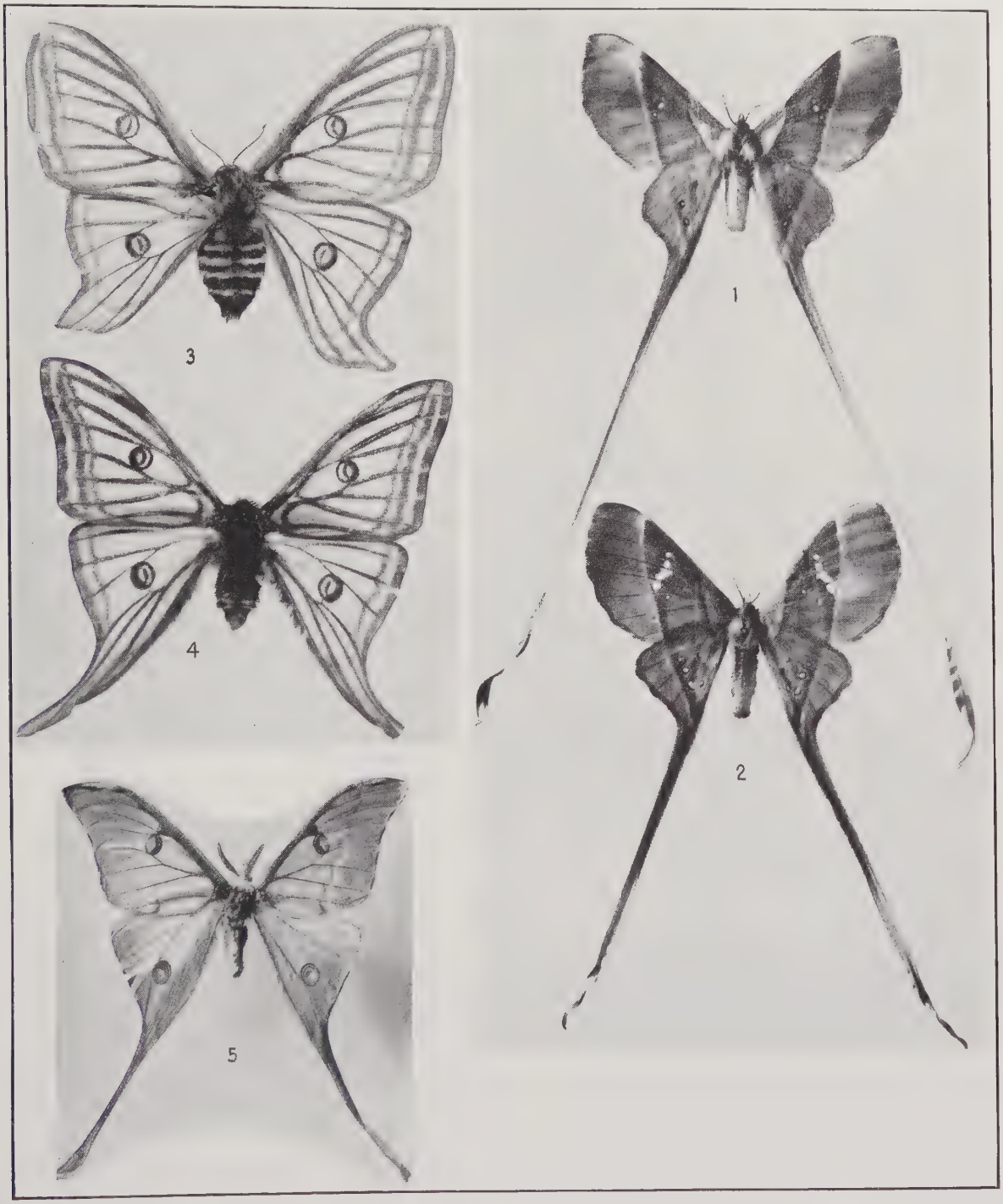
PLATE LXXIII.

Figs. 1, 2.—*Eudaemonia argiphontes*.
Figs. 3, 4.—*Graellsia isabellæ*. [Type of genus.]
Fig. 5 —*Argema mimosæ*. [Type of genus.] Africa. Much reduced.

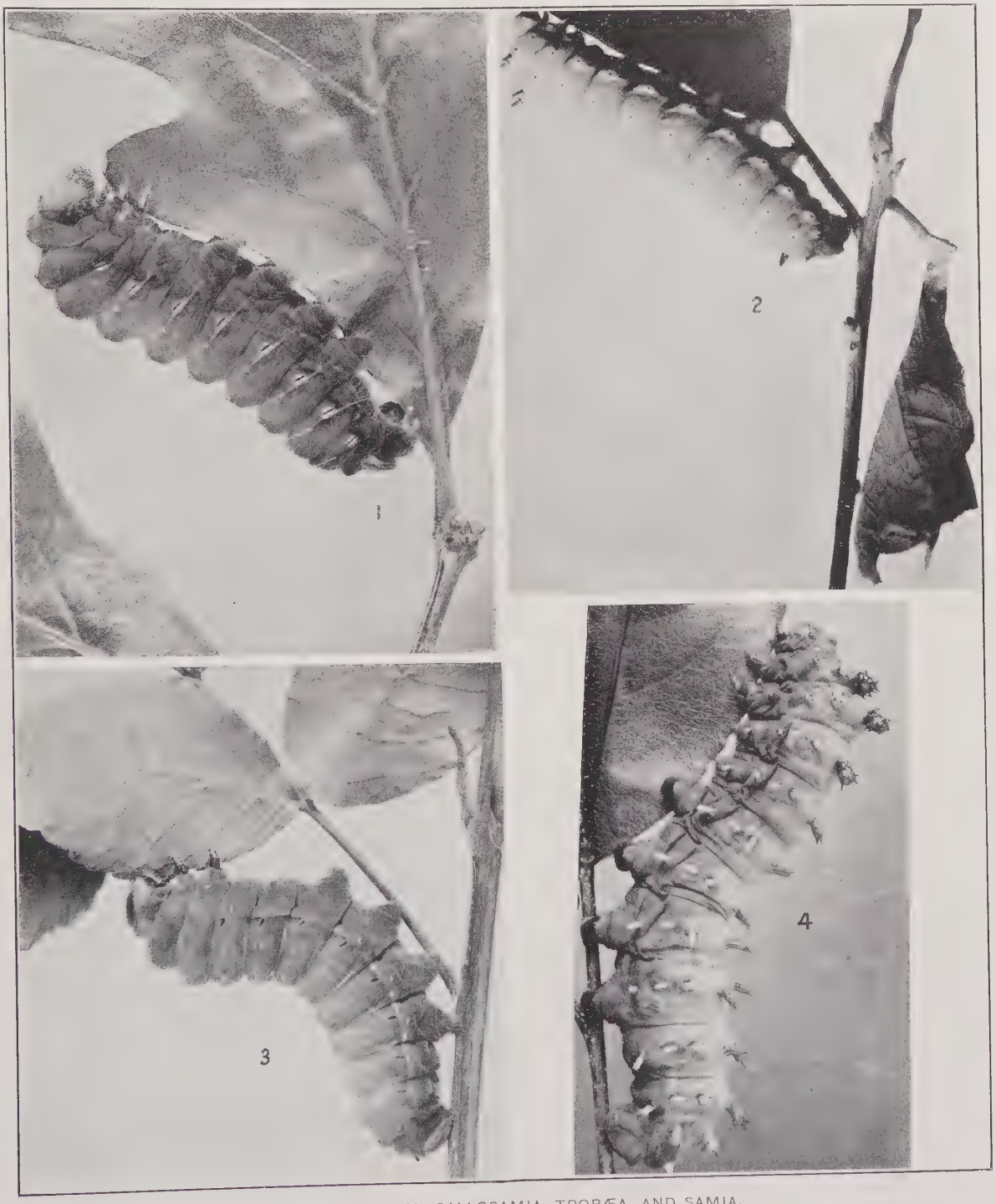


EUDAEMONIA, GRAELLSIA, AND ARGEMA.

PLATE LXXIV.

From photographs by A. Hyatt Verrill.

Fig. 1.—Larva of *Telea polyhemus*. Last stage.
Fig. 2.—*Callosamia promethea*. Last stage of larva and cocoon.
Fig. 3.—Larva of *Tropaea luna*. Last stage.
Fig. 4.—Larva of *Samia cecropia*. Last stage.



LARVÆ OF TELEA, CALLOSAMIA, TROPÆA, AND SAMIA.

PLATE LXXV.

FIG. 1.—*Metosamia godmani* Druce. ♂. Presumably from Jalapa, Mexico, as the others are so labeled.
FIG. 2.—*Telea montezuma* Sallé. ♀. Orizaba, Mexico. (Schaus collection.) In United States National Museum.—H. G. DYAR.

METOSAMIA GODMANI AND M. MONTEZUMA.

PLATE LXXVI.

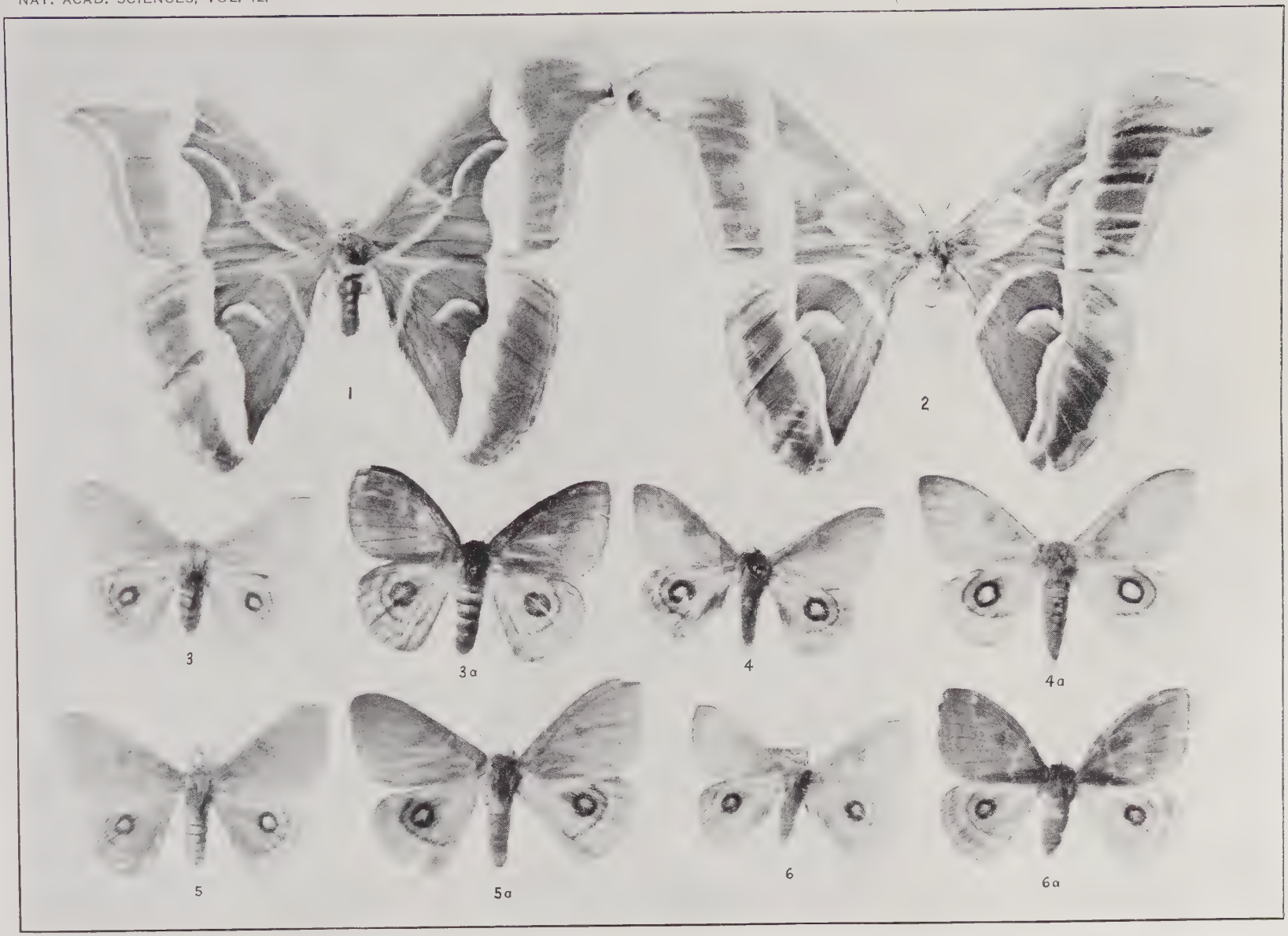
FIG. 1.—*Telea montezuma* Sallé. ♂. Orizaba, Mexico. (Schaus.)
FIG. 2.—*Philosamia cynthia* Drury. Buitenzorg, Java, April, 1909. (Bryant and Palmer.)
FIG. 3.—*Philosamia cynthia* Drury. Male from same source as figure 2.
FIG. 4.—*Agapema copaxoides* Dyar. Type. Iguala, Guerrero, Mexico, June, 1906; 2,800 feet. (Schaus.)
All in United States National Museum.—H. G. DYAR.

METOSAMIA, PHILOSAMIA, AND AGAPEMA.

PLATE LXXVII.

FIG. 1.—*Philosamia pryeri* Butler. Japan (Mitsukuri).
FIG. 2.—*Philosamia lunula* Walker. Chinn Hills [India] (Crowley).
FIG. 3.—*Automeris thyreon* Dyar. Types ♂, ♀.
FIG. 4.—*Automeris melmon* Dyar. Types ♀, ♂.
FIG. 5.—*Automeris dandemon* Dyar. Types ♂, ♀.
FIG. 6.—*Automeris colenon* Dyar. Types ♂, ♀.

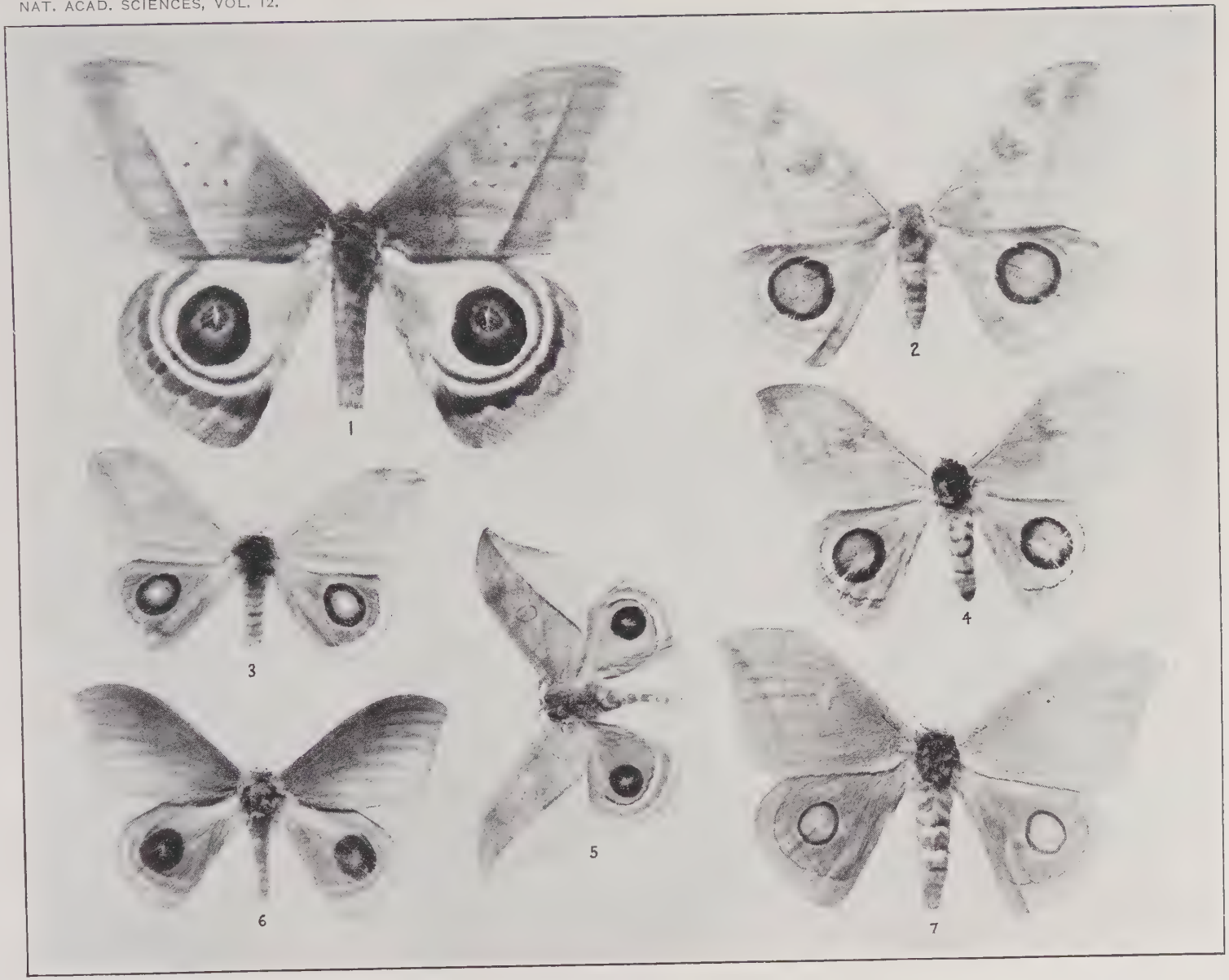
All in United States National Museum.—H. G. DYAR.



PHILOSAMIA AND AUTOMERIS.

PLATE LXXVIII.

FIG. 1.—*Automeris postalbida* Schaus. ♂ type. Balzapamba, prov. de Bolivar, III–IV, 1894 (M. de Mathan).
FIG. 2.—*A. nopaltzin* Schs. ♀ type. Paso San Juan, V. C., Mexico.
FIG. 3.—♂. Cordoba, Mexico (F. Knab). March 31, 1908; thought to be ♂ *nopaltzin*.
FIG. 4.—*A. moresca* Schs. ♂ type. St. Jean, Maroni R., French Guiana.
FIG. 5.—*A. annulata* Schs. ♂ type. Omai, British Guiana.
FIG. 6.—*A. innoxia* Schs. ♂ type. Omai, British Guiana.
FIG. 7.—*A. tamphilius* Schs. ♂ type. Rio Janeiro; very close to *cinctistriga* Felder.
All in United States National Museum.—H. G. DYAR.

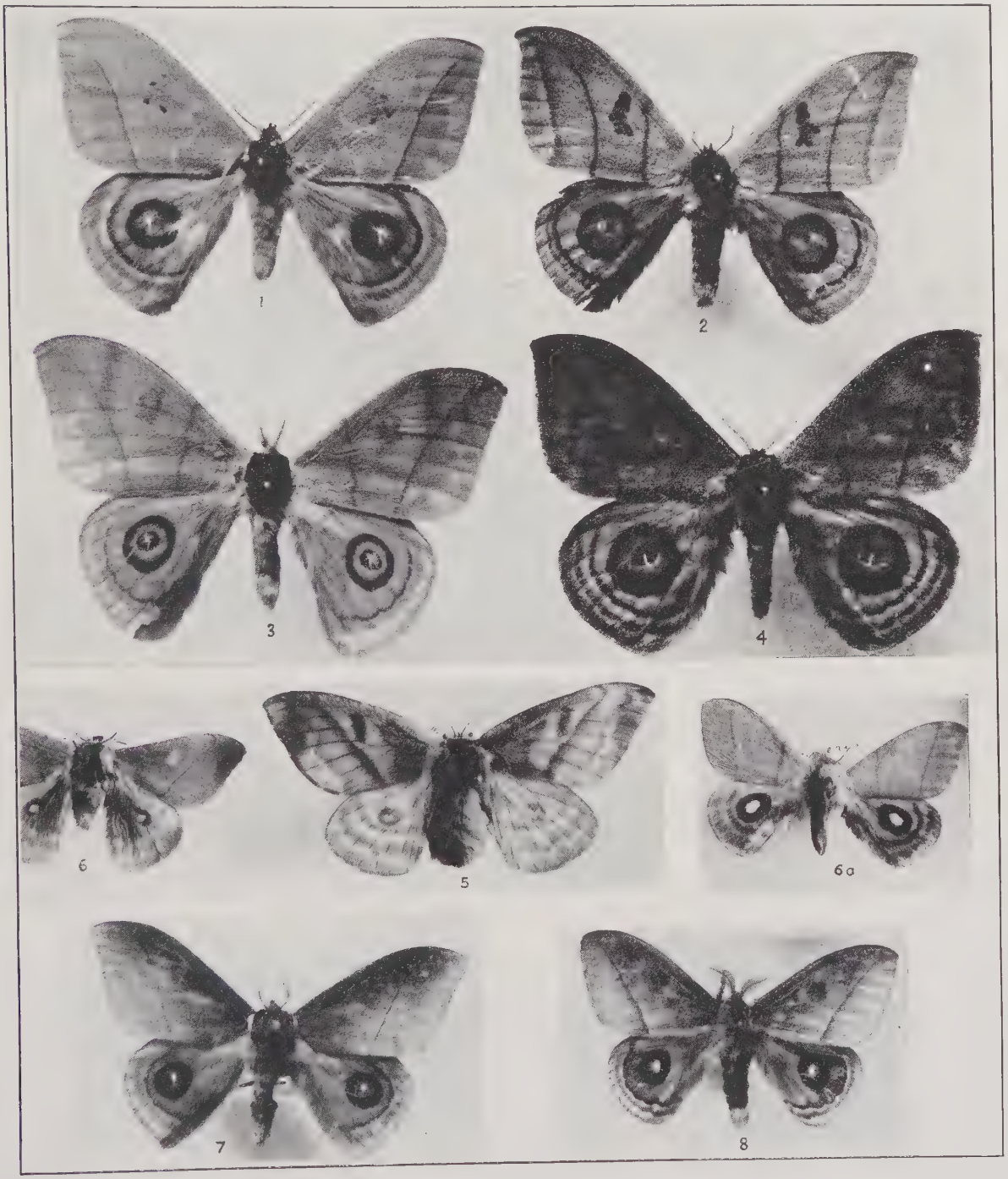


AUTOMERIS.

PLATE LXXIX.

FIG. 1.—*Automeris zaruma* Schs. Type ♂ *zaruma*, Equador (M. de Mathan).
FIG. 2.—*A. curvilinea* Schs. ♂ type. Rio Colorado, Peru, 2,500 feet, August, 1903 (Watkins and Tomlinson).
FIG. 3.—*A. parilis* Schs. Type. Cayenne, French Guiana.
FIG. 4.—*A. amanda* Schs. Type. (No locality label; from Staudinger.)
FIG. 5.—*Hylesia corevia* Schs. ♀ type. Rio Janeiro.
FIG. 6.—*Hylesia corevia* Schs. ♂ type. Rio Janeiro.
FIG. 6A.—*Automeris orodina* Schs. ♂ type. Paraguay.
FIG. 7.—*Automeris pomifera* Schs. ♂ type. Caribaya.
FIG. 8.—*Automeris meridana* Schs. ♂ type. Merida, Venezuela.

All in United States National Museum.—H. G. DYAR.



AUTOMERIS AND HYLESIA.

PLATE LXXX.

FIG. 1.—*Automeris hamata* Schs. ♂ type. Tuis, Costa Rica.
FIG. 2.—*A. flammans* Schs. ♀ type. Columbia (W. E. Pratt).
FIG. 3.—*A. macareis* Schs. ♂ type. Peru.
FIG. 4.—*A. rubicunda* Schs. ♂ type. Petropolis.
FIG. 5.—*A. obscura* Schs. ♂ type.
FIG. 6.—*A. narania* Schs. ♂ type. Rio Grande do Sul.
FIG. 7.—*A. vomona* Schs. ♂ type. Merida, Venezuela.
All in United States National Museum.—H. G. DYAR.
FIG. 8.—*Ludia delegorguei* Boisd.[1] ♂, ♀. [Photographs found among Dr. Packard's MSS., without data or name.]
FIG. 9.—*Attacus edwardsii* White. At rest, three quarters of an hour after emergence. J. H. Watson photograph.

[1] This was provisionally determined as *Holocera similar*. The species being absent from the U. S. Nat. Museum, I sent the photographs to Mr. Watson, who returned them without dissenting from the determination. However, on comparison with Mr. Watson's photographs the insect agrees with *Ludia delegorguei*, and comparison with Dr. Packard's descriptions shows that it belongs to *Ludia*.

AUTOMERIS, LUDIA, AND ATTACUS.

83570°—14——29

PLATE LXXXI.

FIG. 1.—*Hylesia gyrex* Dyar. ♂ type. Omai, British Guiana.
FIG. 2.—*Hylesia tapabex* Dyar. ♂ type. Aroa, Venezuela.
FIG. 3.—*Hylesia tapabex* Dyar. ♀ type. Aroa, Venezuela.
FIG. 4.—*Hylesia hamata* Schs. ♂ type. Tuis, Costa Rica.
FIG. 5.—*Hylesia mymex* Dyar. ♂ type. Colombia (Pratt).
FIG. 6.—*Hylesia rosacea* Schs. ♂ type. Sixola R., Costa Rica.
FIG. 7.—*Hylesia pollex* Dyar. ♂ type. Aroa, Venezuela.
FIG. 8.—*Hylesia pollex* Dyar. ♀ type. Aroa, Venezuela.
FIG. 9.—*Hylesia umbrata* Schs. ♂ type. Tuis, Costa Rica.
FIG. 10.—*Hylesia umbrata* Schs. ♀ type. Sixola R., Costa Rica.
FIG. 11.—*Hylesia valvex* Dyar. ♂ type. St. Jean, Maroni R., French Guiana.
FIG. 12.—*Hylesia valvex* Dyar. ♀ type. St. Laurént, Maroni R., French Guiana.
FIG. 13.—*Hylesia terranea* Schs. ♀ type. Petropolis.
FIG. 14.—*Hylesia murex* Dyar. ♂ type. Geldersland, Surinam R., Dutch Guiana.
FIG. 15.—*Hylesia ascodex* Dyar. ♂ type. Rio Huacamaya, Peru.
FIG. 16.—*Hylesia leilex* Dyar. ♂ type. Rio Huacamaya, Peru.
FIG. 17.—*Hylesia oratex* Dyar. ♂ type. Castro Parana, Brazil.
FIG. 18.—*Hylesia livex* Dyar. ♂ type. Rio Janeiro, Brazil.
FIG. 19.—*Hylesia remex* Dyar. ♂ type. Rio Janeiro, Brazil.
FIG. 20.—*Hylesia orbifex* Dyar. ♂ type. Rio Janeiro, Brazil.
FIG. 21.—*Hylesia liturex* Dyar. ♂ type. 60 miles up Maroni R., French Guiana.

All in United States National Museum.—H. G. DYAR.

HYLESIA.

PLATE LXXXII.

FIG. 1.—*Hylesia molpex* Dyar. ♂ type. St. Jean, French Guiana.
FIG. 2.—*Hylesia rex* Dyar. ♂ type. St. Jean, French Guiana.
FIG. 3.—*Hylesia coex* Dyar. ♂ type. Aroa, Venezuela.
FIG. 4.—*Hylesia mortifex* Dyar. ♂ type. Aroa, Venezuela.
FIG. 5.—*Hylesia lolamex* Dyar. ♂ type. Aroa, Venezuela.
FIG. 6.—*Hylesia murmur* Dyar. ♂ type. S. Domingo, Peru.
FIG. 7.—*Hylesia indurata* Dyar. ♂ type. St. Jean, French Guiana.
FIG. 8.—*Hylesia mystica* Dyar. ♂ type. Trinidad.
FIG. 9.—*Hylesia mystica* Dyar. ♀ type. Trinidad.
FIG. 10.—*Hylesia schausi* Dyar. ♀ type. Aroa, Venezuela.
FIG. 11.—*Hylesia schausi* Dyar. Supposed ♂. Aroa, Venezuela.
FIG. 12.—*Hylesia cedomnibus* Dyar. ♂ type. Rio Huacamaya, Peru.
FIG. 13.—*Hylesia pauper* Dyar. ♂ type. Rio Huacamaya, Peru.
FIG. 14.—*Hylesia athlia* Dyar. ♂ type. Rio Huacamaya, Peru.
FIG. 15.—*Hylesia vindex* Dyar. ♂ type. Rio Janeiro.
FIG. 16.—*Hylesia solvex* Dyar. ♂ type. Rio Grande do Sul.
FIG. 17.—*Hylesia frigida* Schs. ♂ type. Turrialba, Costa Rica.

All in United States National Museum.—H. G. DYAR.

HYLESIA.

PLATE LXXXIII.

FIG. 1.—*Hylesia coinopus* Dyar. ♂ type. Coatepec, Mexico. (Gugelmann.)
FIG. 2.—*Hylesia rufipes* Schs. ♂ type. Sixola R., Costa Rica.
FIG. 3.—*Hylesia annulata* Schs. ♂ type. Sixola R., Costa Rica.
FIG. 4.—*Hylesia ochrifex* Dyar. ♂ type. Rio Huacamaya, Peru.
FIG. 5.—*Hylesia index* Dyar. ♂ type. Rio Huacamaya, Peru.
FIG. 6.—*Hylesia rubrifrons* Dyar. ♂ type. Tuis, Costa Rica.
FIG. 7.—*Hylesia dalina* Dyar. ♂ type. Sixola R., Costa Rica.
FIG. 8.—*Hylesia multiplex* Schs. ♂ type. Sixola R., Costa Rica.
FIG. 9.—*Hylesia euphemia* Dyar. ♂ type. Misantla, Mexico. (Gugelmann.)
FIG. 10.—*Hylesia euphemia* Dyar. ♀ type. Misantla, Mexico. (Gugelmann.)
FIG. 11.—*Hylesia cressida* Dyar. ♂ type. Cuernavaca, Mexico. (Schaus.)
FIG. 12.—*Hylesia cressida* Dyar. ♀ type. Cuernavaca, Mexico. (Schaus.)

All in United States National Museum.—H. G. DYAR.

HYLESIA.

PLATE LXXXIV.

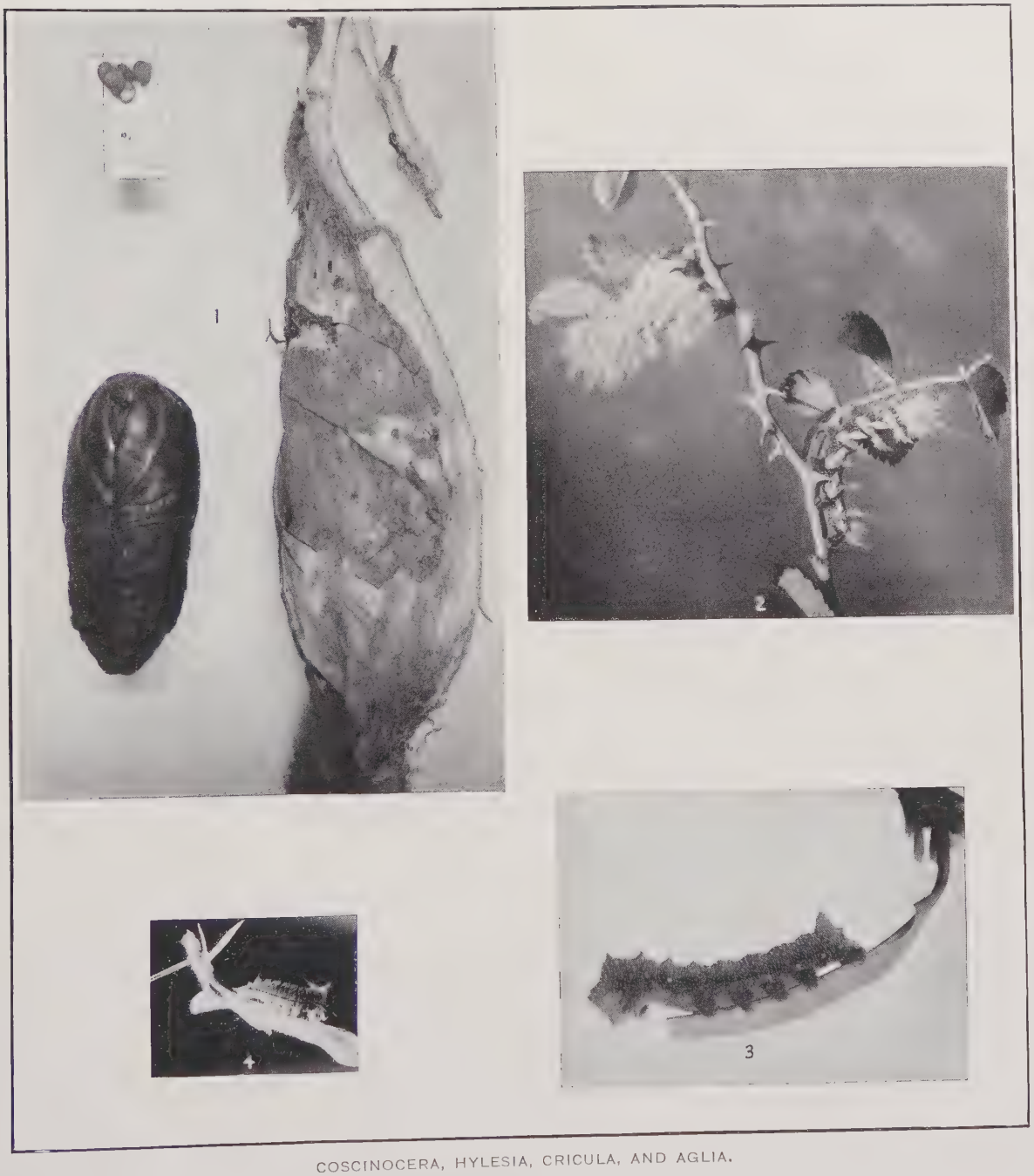
FIG. 1.—*Coscinocera hercules* (Miskin). Male pupa and cocoon. "Antennæ covers wider than wing case."

FIG. 2.—*Hylesia muscula.* Brazil. Bred on *Rosa* by J. H. Watson. "Color black, with cream dots; the oblique shades are cream; spines pale green; the darker tone separating the oblique slashes is a pale lilac." (Watson.)

FIG. 3.—*Cricula andrei* Jordan. Apple green. On *Rhododendron ponticum;* April 3.

Fig. 4.—*Aglia tau* (Linné). April 3.

All photographed by J. H. Watson.—J. H. WATSON.



COSCINOCERA, HYLESIA, CRICULA, AND AGLIA.

PLATE LXXXV.

Coscinocera hercules (Misk.) *a*, male; *b*, cocoon; *c*, male pupa; *d*, eggs. Bred from cocoon by F. P. Dodd, from larva taken at Port Darwin, North Australia.

All in collection of J. H. Watson.—J. H. Watson.

COSCINOCERA HERCULES.

PLATE LXXXVI.

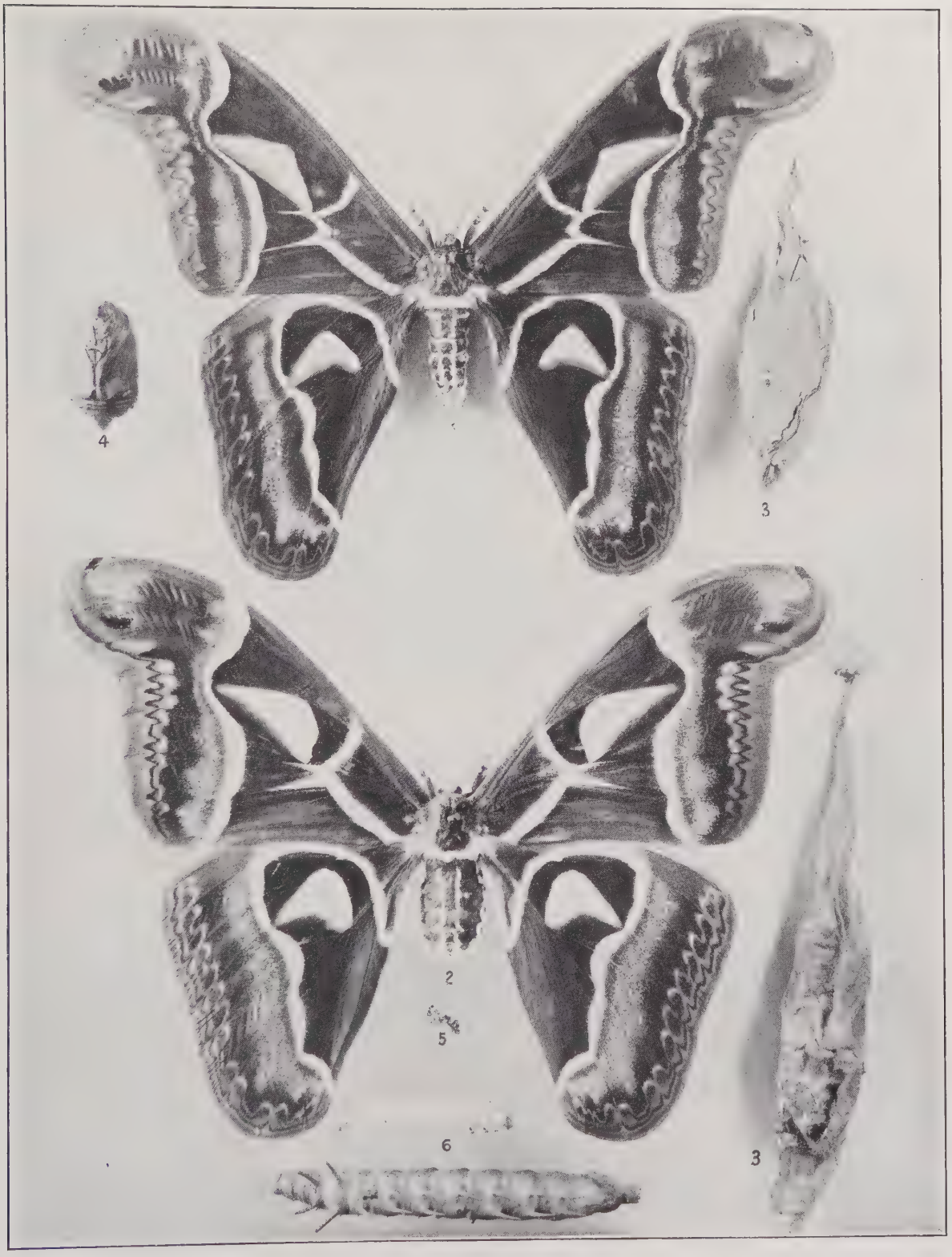
Coscinocera hercules (Misk.). *a*, female; *b*, cocoon. From the same source as those figured on Plate LXXXV. All in collection of J. H. Watson.—J. H. Watson.

COSCINOCERA HERCULES, FEMALE AND COCOON.

PLATE LXXXVII.

Archæoattacus edwardsi (White). 1, male; 2, female; 3, cocoon; 4, female pupa; 5, eggs; 6, larva, fourth and fifth stages. From Darjeeling, India. Imagos bred from cocoon June 20 and 26, 1911. Larvæ reared by J. H. W. on *Ailanthus glandulosa*. August, 1911.

All in collection of J. H. Watson.—J. H. Watson.



ARCHÆOATTACUS EDWARDSI.

PLATE LXXXVIII.

Blown larvæ of Attacinæ.

Fig. a.—*Philosamia ricini* (Hutt.)=*lunula* (Walk.); spotless form. Bred J. H. W., parents from wild cocoons Assam.

Fig. b.—*P. canningi* (Hutt.). Bred from eggs by E. André; parents from cocoons, Darjeeling, India.

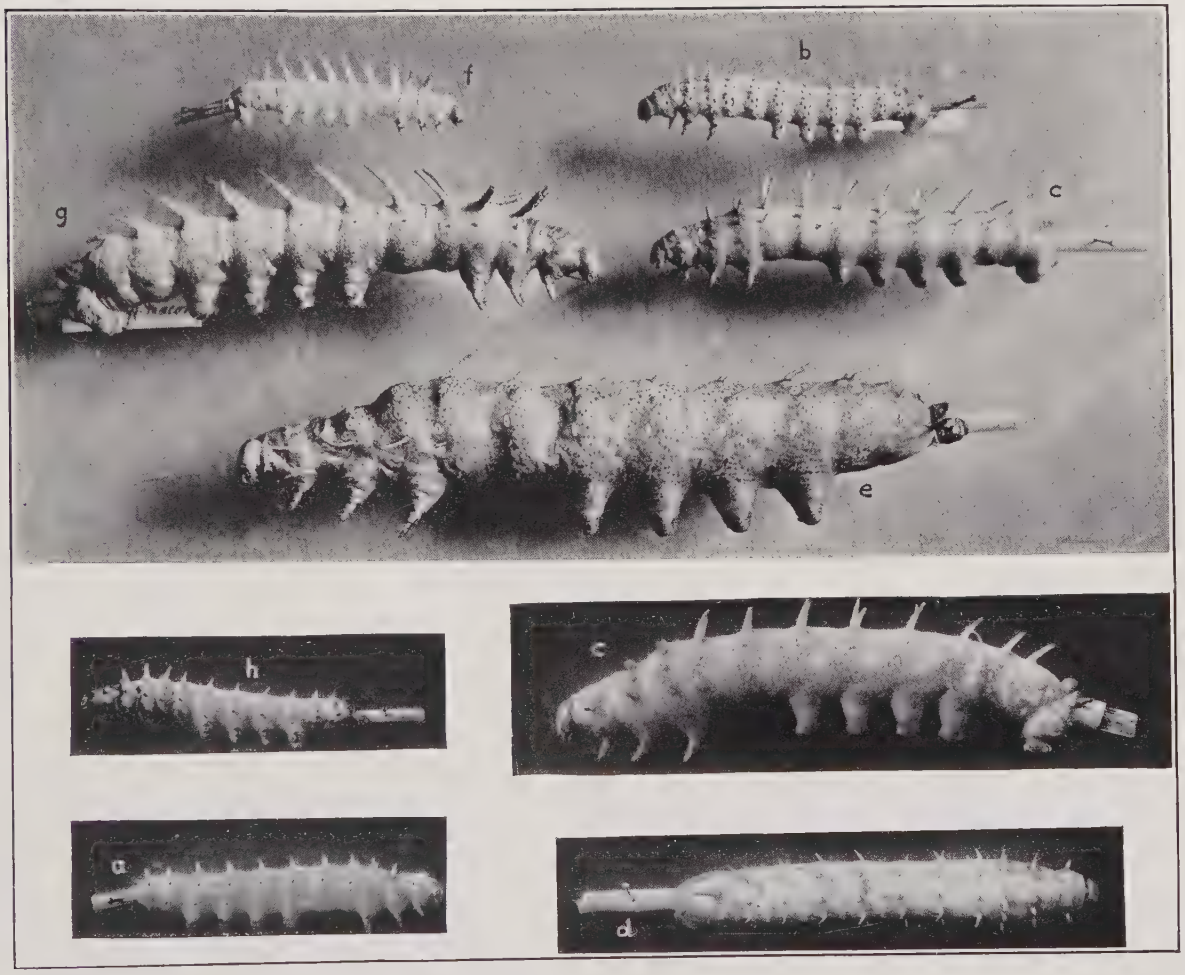
Fig. c, d.—*Archaeoattacus edwardsi*×*Attacus atlas atlantis*. Hybrid larvæ, fourth stage; hybridized by Huwe, reared by E. André.

Fig. e.—*Attacus atlas* (L.). West Java.

Figs. f, g.—*Archaeoattacus edwardsi;* fourth and fifth stages. Bred J. H. W.; August, 1910.

Fig. h.—*Epiphora mythimnia* (Westwood). Bred from eggs by G. F. Leigh, Durban, South Africa.

All in collection of J. H. Watson.—J. H. Watson.

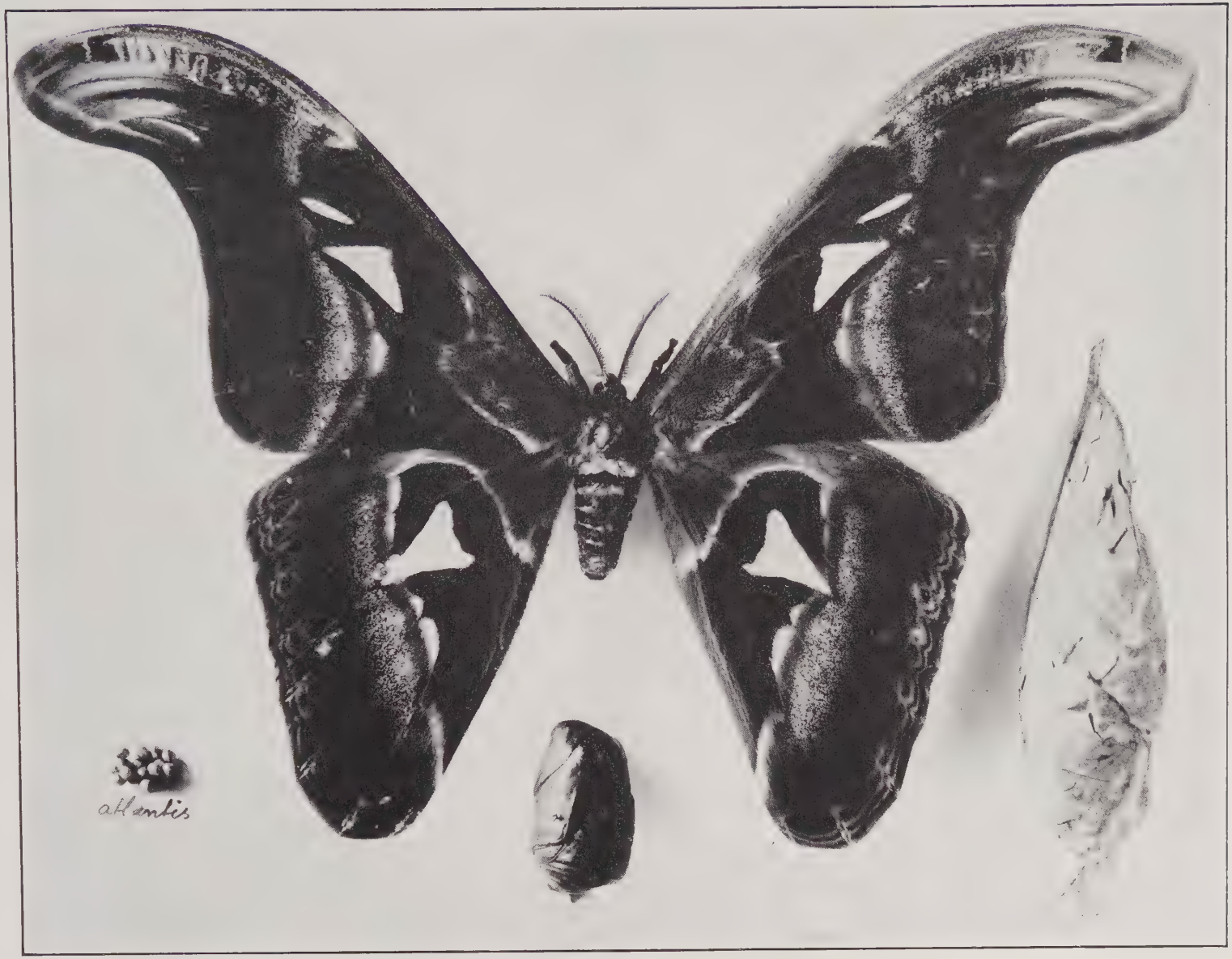


LARVÆ OF PHILOSAMIA, ATTACUS, ARCHÆOATTACUS, AND EPIPHORA.

8357°—14——30

PLATE LXXXIX.

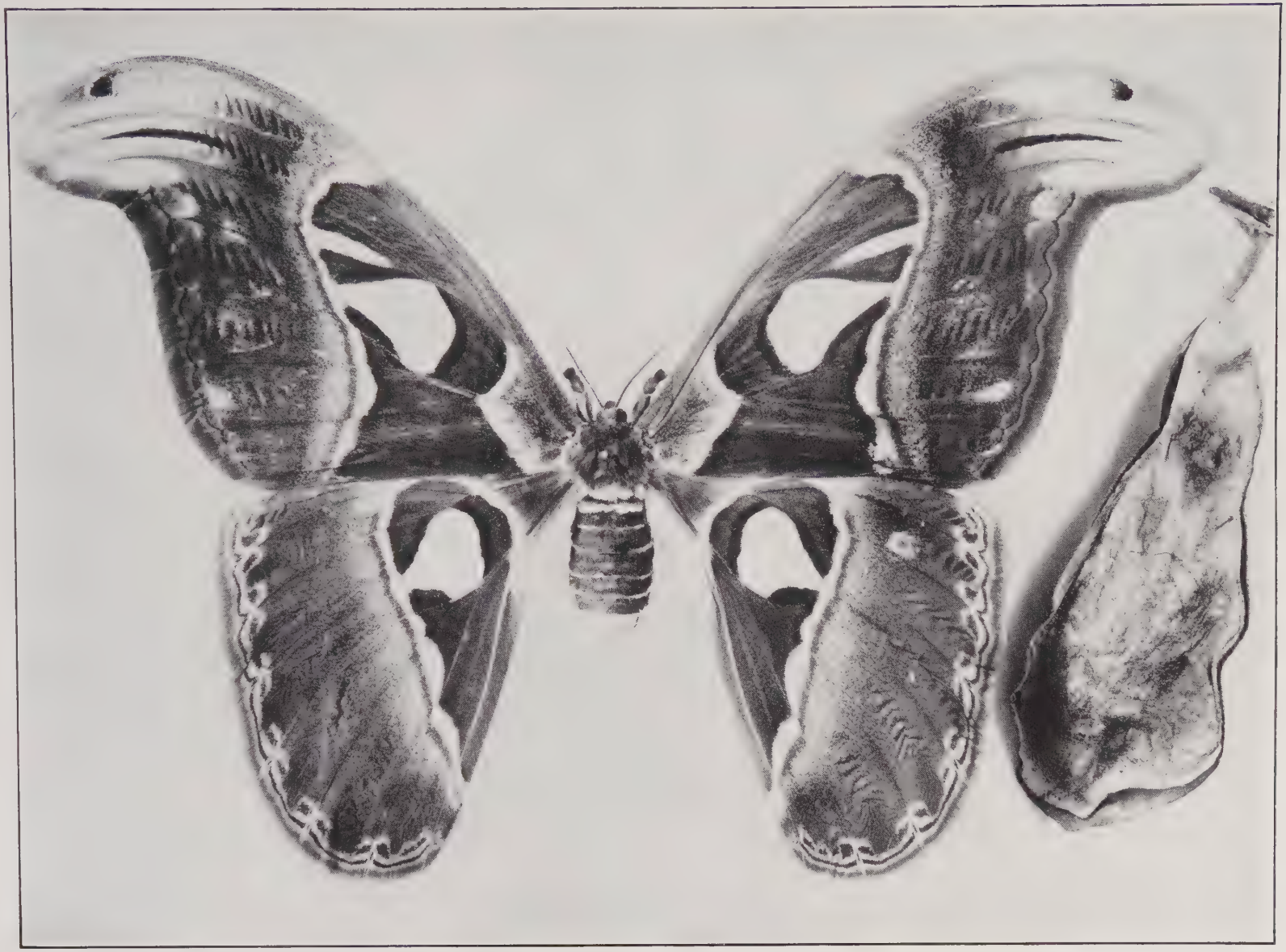
Attacus atlas atlantis Staudinger. a, male; b, female pupa; c, eggs; d, cocoon. Bred by J. H. W. All in collection of J. H. Watson.—J. H. Watson.



ATTACUS ATLAS ATLANTIS.

PLATE XC.

Attacus atlas (L.). a, female; b, cocoon. Hatched from cocoon from Khasia Hills, India June 15, 1912. In collection of J. H. Watson.—J. H. Watson.



ATTACUS ATLAS, FEMALE AND COCOON.

PLATE XCI.

FIG. a.—*Attacus atlas mcmulleni* Watson, male. Bred from larva reared by W. R. McMullen, Port Blair, Andaman Island. Emerged May 13, 1912.

FIG. b.—*Archaeoattacus edwardsi* (White), male. Bred from cocoon by J. H. W.; May 16, 1912. Larva taken near Darjeeling, India.

Both in collection of J. H. Watson.—J. H. WATSON.

ATTACUS AND ARCHÆOATTACUS.

PLATE XCII.

FIGS. a (male), b (female).—*Philosamia cynthia=insularis* (Voll.). West Java.

FIGS. c (male), d (female).—*Philosamia walkeri* (Feld.). Bred by Rev. G. F. Francke from larva taken at Cheng-tu, West China.

In collection of J. H. Watson.—J. H. WATSON.

PHILOSAMIA.

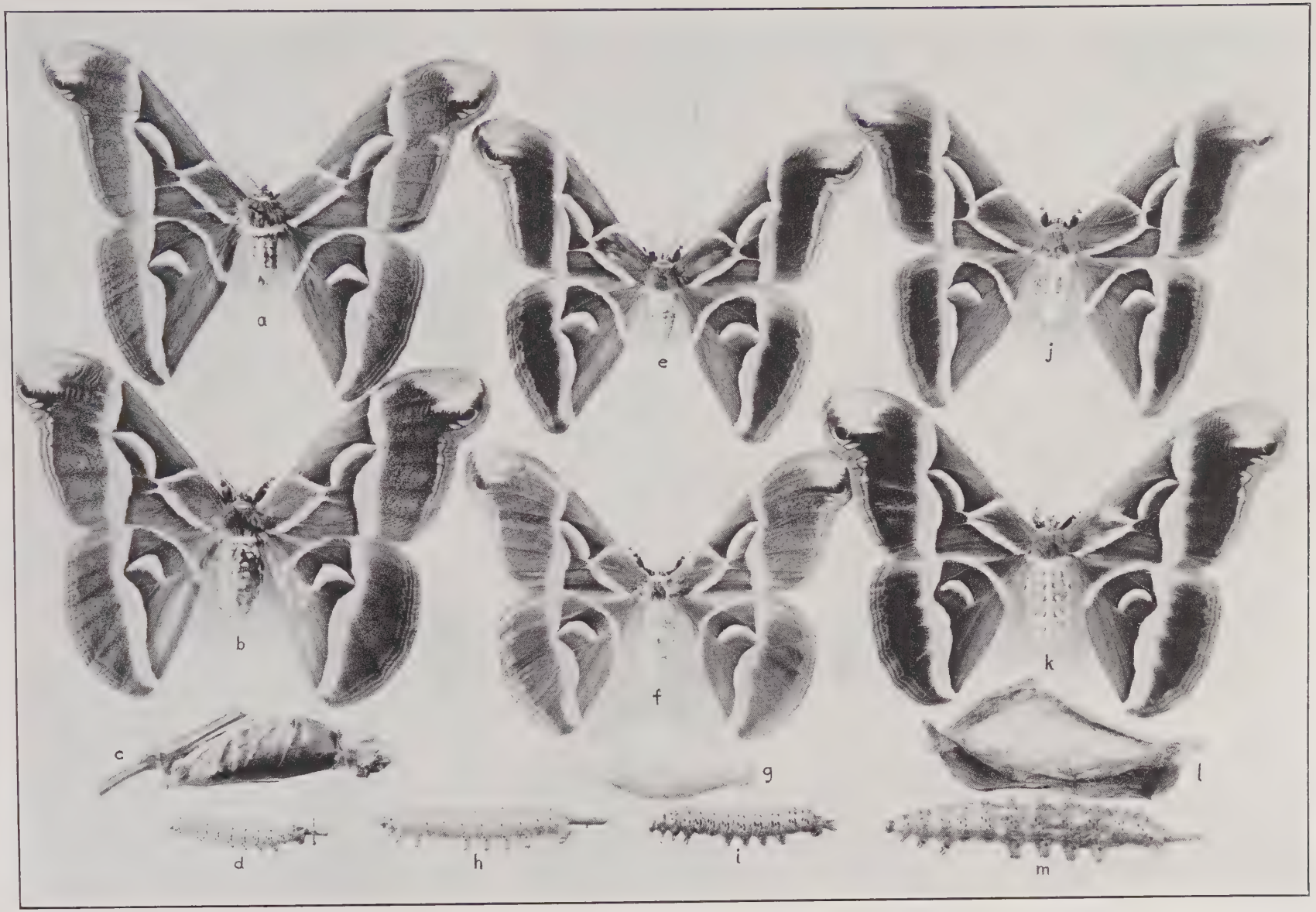
PLATE XCIII.

Philosamia walkeri (Feld.). American form. a, male; b, female; c, cocoon; d, larva. Bred J. H. W. Cocoons from New York.

Philosamia ricini (Hutt.)=*lunula* (Walk.). e, male; f, female; g, cocoon; h, i, spotless and spotted larvæ. Bred J. H. W. from wild cocoons, Assam.

Philosamia walkeri (American race) ♂ ×*lunula* ♀ =*Attacus vesta* Walker. j, male; k, female; l, cocoon; m, larva Bred J. H. W.

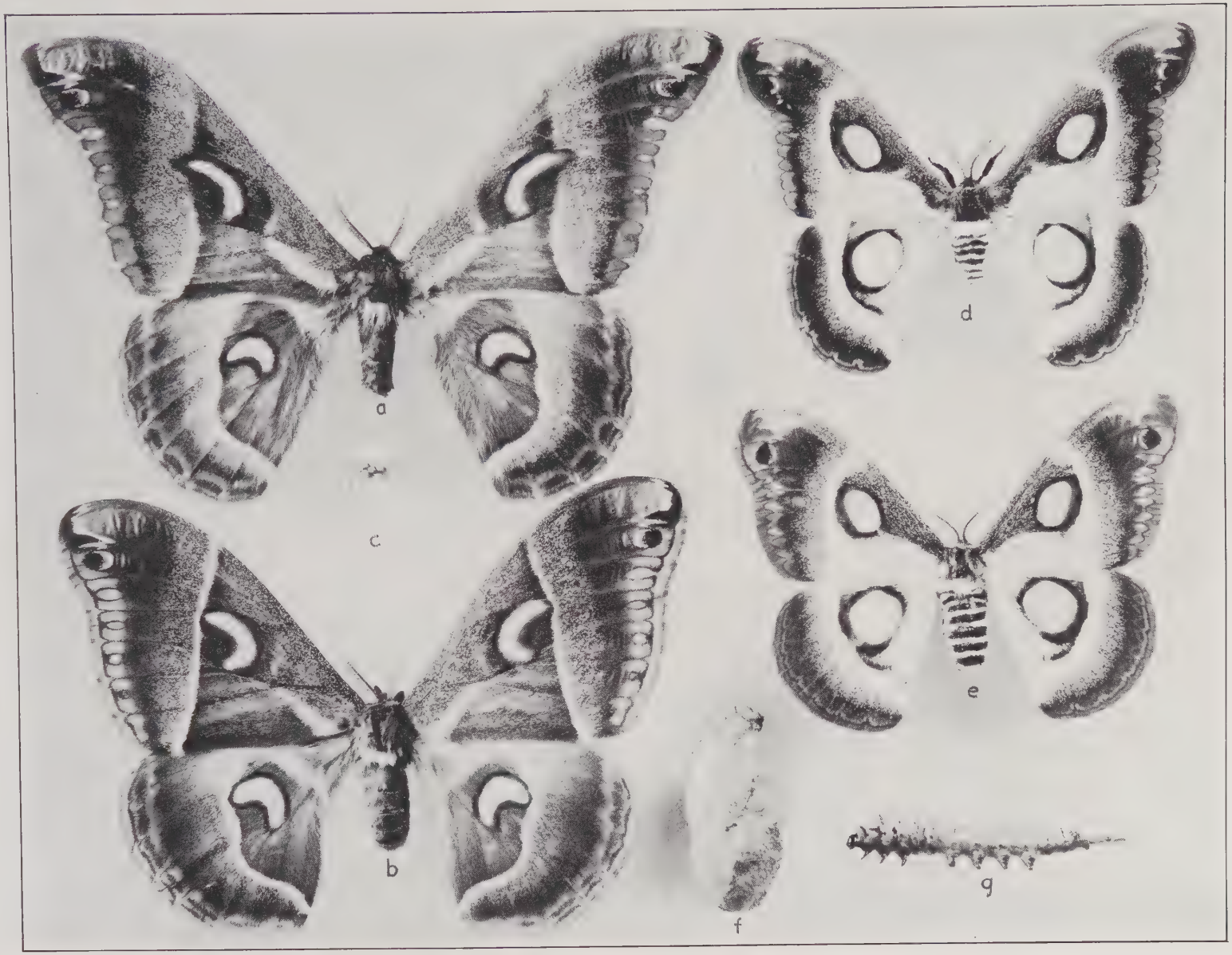
All in collection of J. H. Watson.—J. H. Watson.



PHILOSAMIA.

PLATE XCIV.

Figs. a (male), b (female), c (eggs).—*Drepanoptera vacuna* (Westwood). North Rhodesia, South Africa.
Figs. d (male), e (female), f (cocoon).—*Epiphora bauhiniae* (Guér.). Senegal, West Africa.
Fig. g (larva).—*Epiphora mythimnia* (Westwood). Bred by G. F. Leigh, Durban, South Africa.
All in collection of J. H. Watson.—J. H. Watson.



DREPANOPTERA AND EPIPHORA.

PLATE XCV.

Actias selene (Hübner). Fig. a, male; parents from wild Bengal cocoons; reared J. H. W., on *Salix fragilis;* f, b, female; f, c, d, cocoons, one showing cremaster attachment; f, e, pupa. All from cocoons from Khasia Hills.

Actias selene callandra Jordan, 1911. Fig. f, male; f, g, cocoon. From larva taken at Port Blair, Andaman Island, by W. R. McMullen; hatched May 5, 1912.

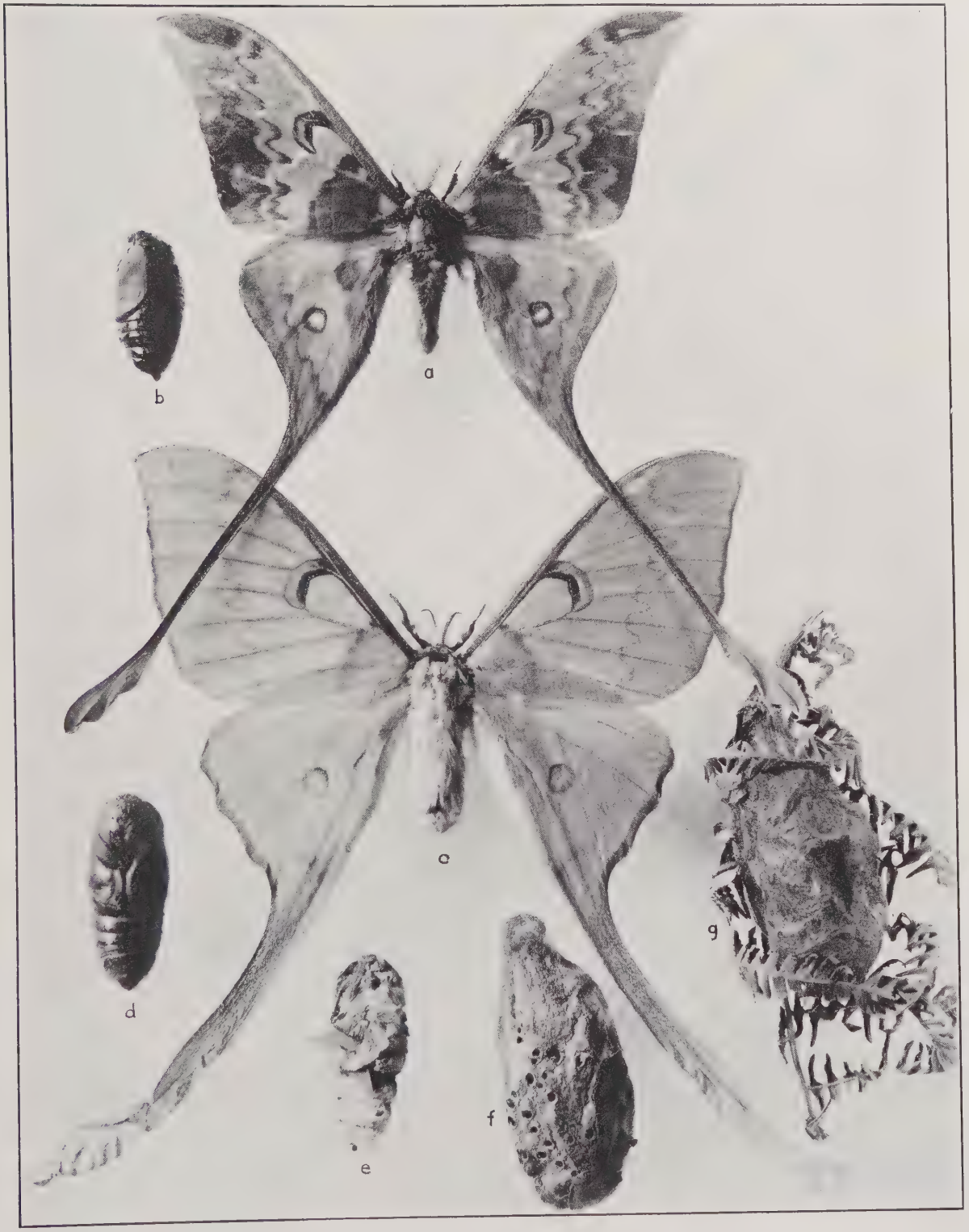
All in collection of J. H. Watson.—J. H. Watson.

ACTIAS SELENE AND A. CALLANDRA.

PLATE XCVI.

Argema moenas (Doubleday). Fig. a, male [=*leto* Doubl.]; b, male pupa; c, female; d, female pupa; e, imago from pupa, showing curve of tail under pupal wing cover; f, cocoon, showing valve and perforations; g, imperforate and valveless cocoon. All from larvæ taken in Khasia Hills, Assam. The female emerged April 15, 1910.

All in collection of J. H. Watson.—J. H. Watson.



ARGEMA MOENAS.

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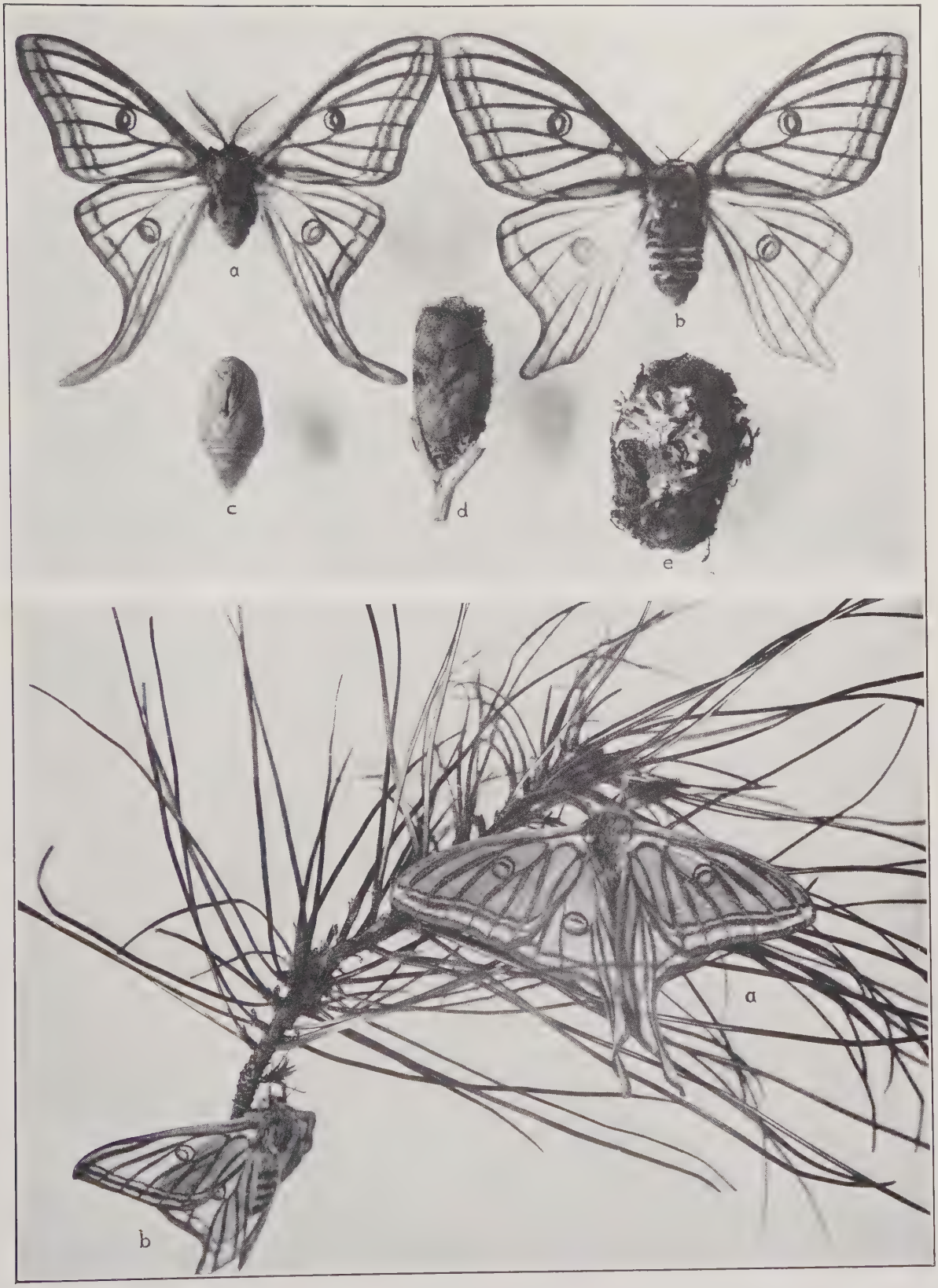
PLATE XCVII.

Graellsia isabellæ (Graells). Fig. a, male; b, female; c, male pupa; d, e, cocoons. Guadalajara, Spain. Bred J. H. W., from cocoons on *Pinus maritima*. The lower figure shows the living moths (a, male; b, female) on *Pinus maritima*, illustrating the resemblance of markings to the pine foliage.

All in collection of J. H. Watson.—J. H. Watson.



GRAELLSIA ISABELLÆ.

PLATE XCVIII.

Rinaca thibeta extensa (Butler). Fig. 1a, male; 1b, female; 1c, cocoon; 1d, pupa shell. All bred from cocoons taken at Ghoon, November 10, 1910.

Eriogyna pyretorum (Westwood). Fig. 2a, male; 2b, female; 2c, eggs; 2d, pupa; 2e, 2f, cocoons; of subspecies *pearsoni* (Watson). Bred from cocoons obtained in mountains of interior of Hainan.

E. pyretorum luctifera Jordan. Fig. 2g, male; 2h, female. Both bred from larvæ taken by Rev. G. F. Francke at Ching-tu, West China, on a tree resembling mountain ash (*Pyrus*). Spun up at end of May, hatched December, 1911.

Dictyoploca simla (Westwood). Fig. 3a, male; 3b, female; 3c, male pupa; 3d, cocoons. All bred from cocoons from Khasia Hills, Assam. Hatched September, 1911. Rev. G. F. Francke, who was stationed in West China (Chang-tu), tells me that there he has found the cocoons on the shady side of trunks and branches of trees. The cocoons I have usually had from Assam are loosely enveloped in *Salix* leaves. I have reared the larvæ on *Salix fragilis*. The larva of *Dictyoploca* (?) *cachara* (Moore) is very unlike that of *D. simla* and *D. japonica*.

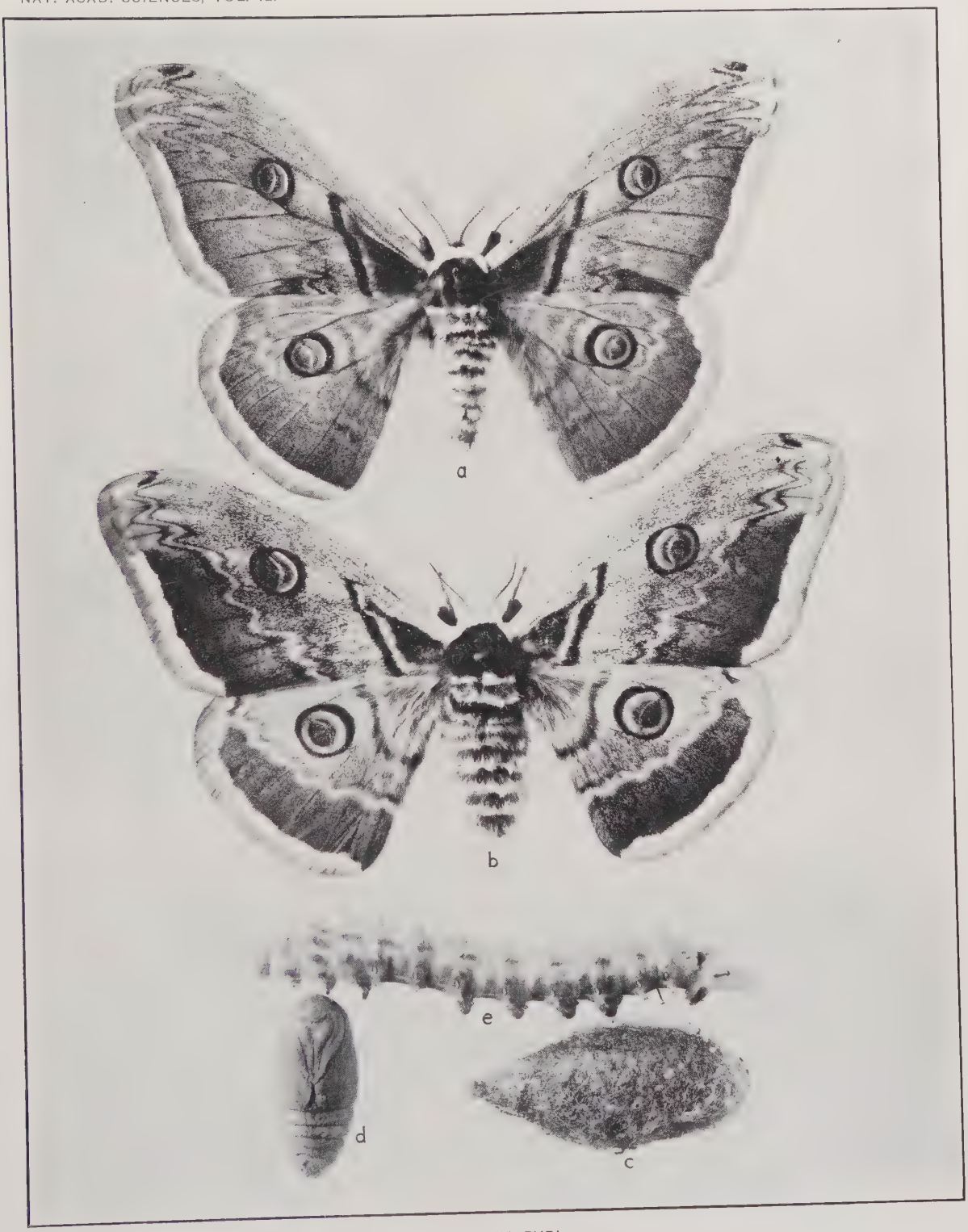
All in collection of J. H. Watson.—J. H. Watson.

RINACA, ERIOGYNA, AND DICTYOPLOCA.

PLATE XCIX.

Saturnia pyri (D. and S.). Fig. a, male; c, cocoon; d, female pupa; e, larva. All bred J. H. W.: parents from Lower Austria. Fig. b, female from Syria; bred J. H. W., April 10, 1912.

All in collection of J. H. Watson.—J. H. Watson.



SATURNIA PYRI.

PLATE C.

FIG. 1, a–f.—*Eudia spini* (D. and S.)=*pavonia-media* (Fabr.). a, male; b, female; c, larva; d, cocoons; e, male pupa; f, female pupa. All bred from larvæ on *Crataegus*. The original cocoons from Hohenau, Lower Austria.

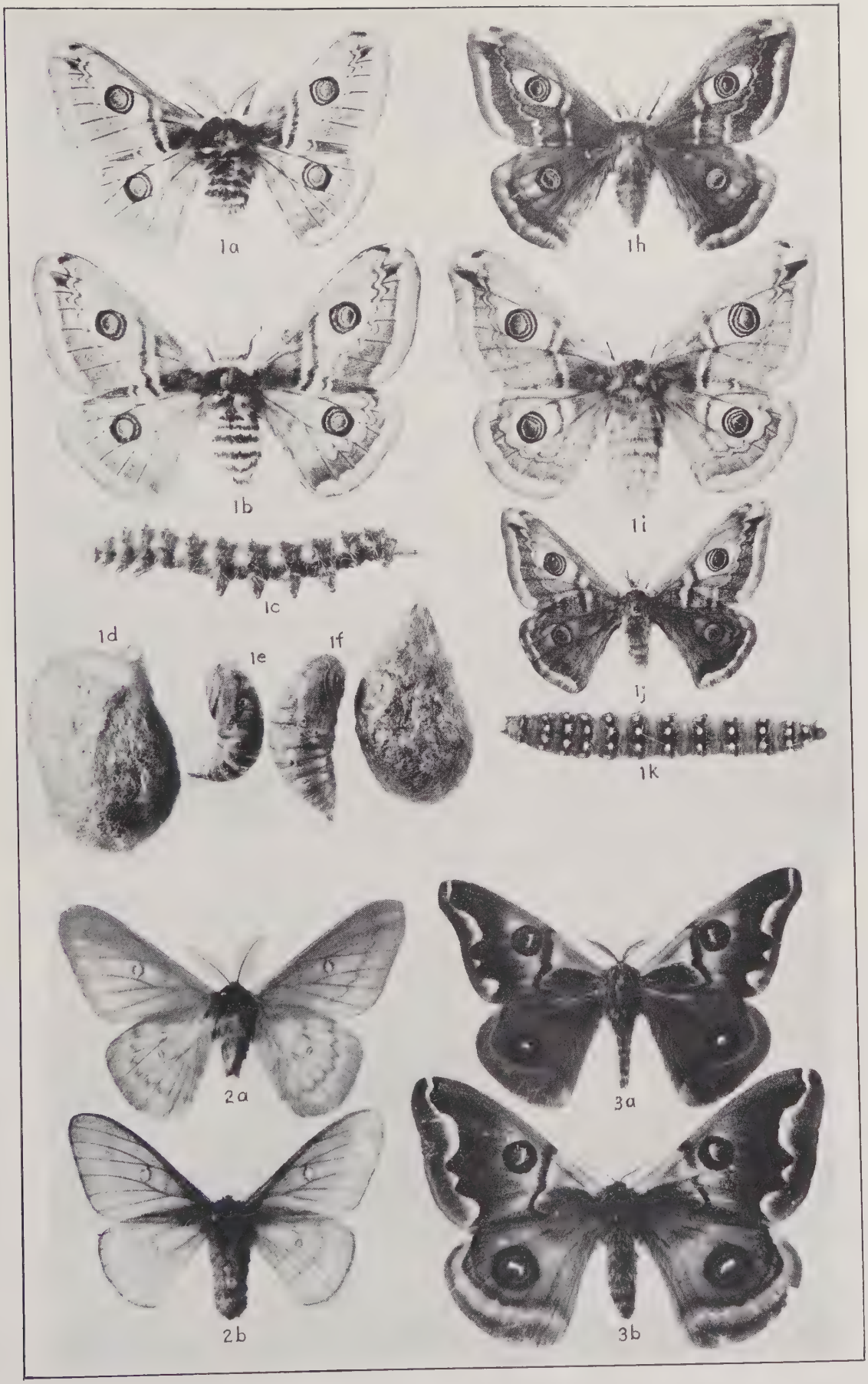
FIG. 1, h–k.—*Eudia carpini* (D. and S.)=*pavonia-minor* (L.). Fig. h, male; i, female, of subspecies *meridionalis*. Bred J. H. W. from cocoons from Syria. Fig. j, male (melanic aberration); k, larva, both from Wilmslow, Cheshire, England.

FIG. 2.—*Perisomena caecigena* (Kup.). Fig. a, male; b, female. Bred from cocoons from Syria.

FIG. 3.—*Polythysana rubrescens* (Blanch). Fig. a, male; b, female.

All in collection of J. H. Watson.—J. H. WATSON.

[Dr. Dyar notes that fig. 3 is not identical with the species labeled *Polythysana rubrescens* in the United States National Museum.]

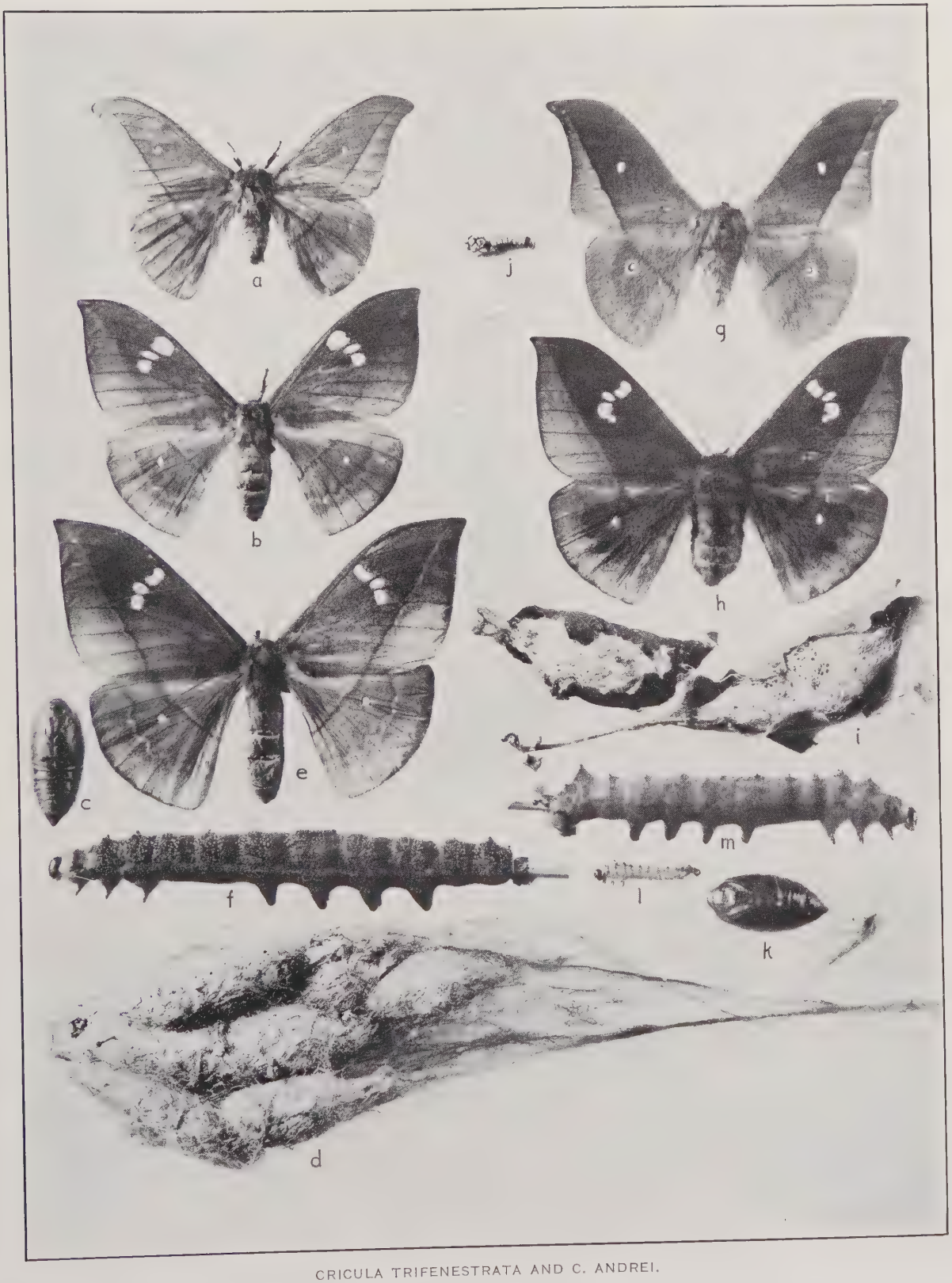


EUDIA, PERISOMENA, AND POLYTHYSANA.

PLATE CI.

Cricula trifenestrata (Helf.). Fig. a, male; b, female; c, pupa; d, gregarious cocoons. All from Khasia Hills, Assam.
C. trifenestrata. Fig. e, female; f, larva; West Java.
C. andrei Jordan. Fig. g, male; h, female; i, solitary cocoons; j, eggs; k, pupa; l, larva in third stage; m, larva in fifth stage. All bred J. H. W. from wild cocoons, Khasia Hills and Sikkim, India.

All in collection of J. H. Watson.—J. H. Watson.



CRICULA TRIFENESTRATA AND C. ANDREI.

PLATE CII.

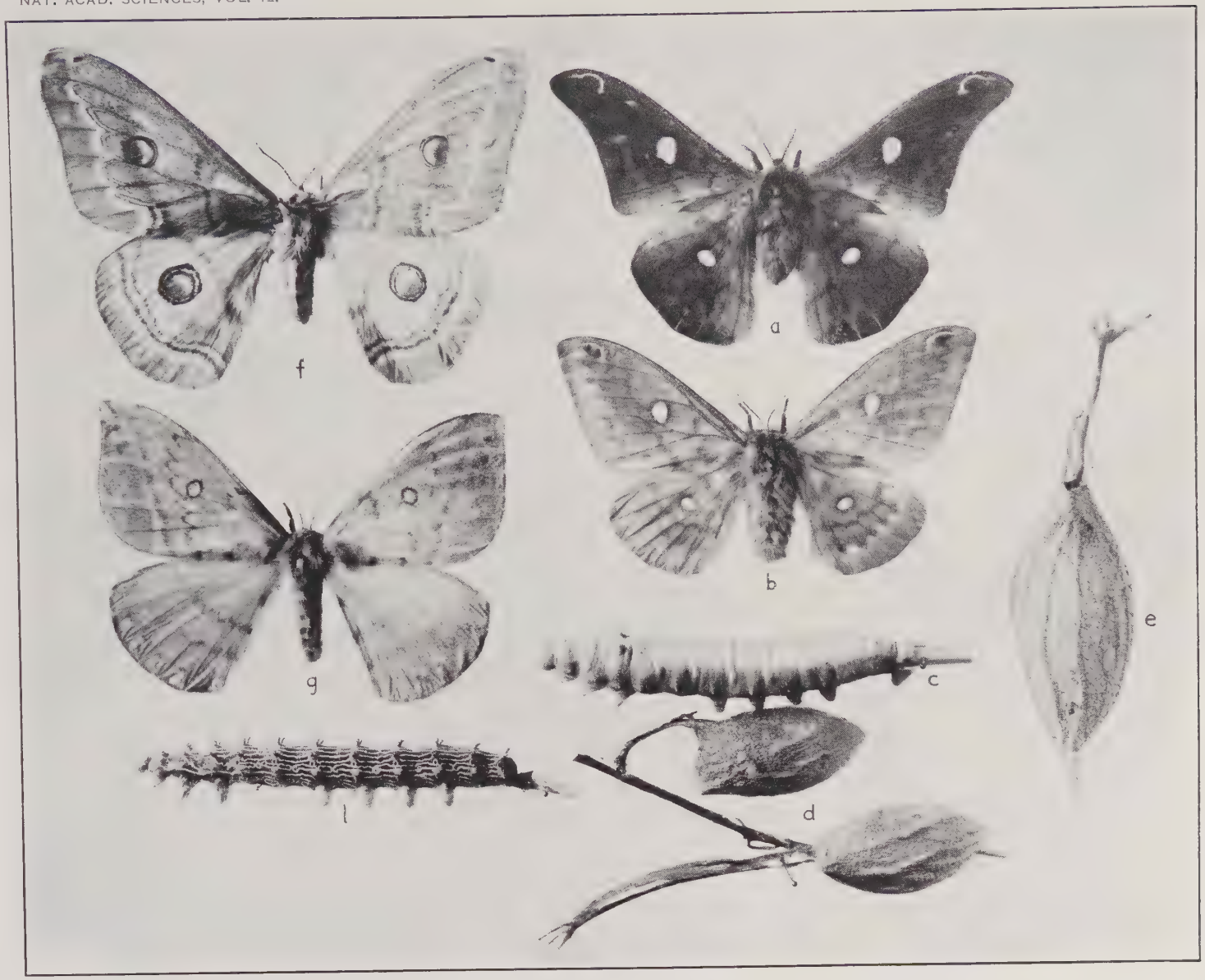
Rhodia fugax Butler. Fig. a, male; b, female; c, larva; d, cocoons. Bred J. H. W. on *Salix*, from wild eggs from Gifu, Japan.

Rhodia newara Moore. Fig. e, cocoon. Darjeeling, India.

Neoris schenki (Staudinger). Fig. f.

Tagoropsis natalensis Felder. Fig. g, female. Northern Rhodesia, collected by Gimson. Fig. l, larva, bred from egg by G. F. Leigh, Durban, Natal. [The species from Durban was sent as *T. flavinata* Walker by Mr. Leigh; it is almost identical with the insect from Rhodesia. Kirby considered *natalensis* a synonym of *flavinata*.]

All in collection of J. H. Watson.—J. H. Watson.



RHODINIA, NEORIS, AND PSEUDOPHELIA.

PLATE CIII.

Aglia tau (Linné). Figs, a, a′, male, upper and under surface; b, female; c, pupa; d, cocoons. Bred J. H. W. on hawthorn, the original pupæ from Lower Austria.

A. tau fere-nigra Th. M. Fig. e, male; f, female.

A. tau fere-nigra subcaeca. Fig. g, male. Styria (H. Huemer).

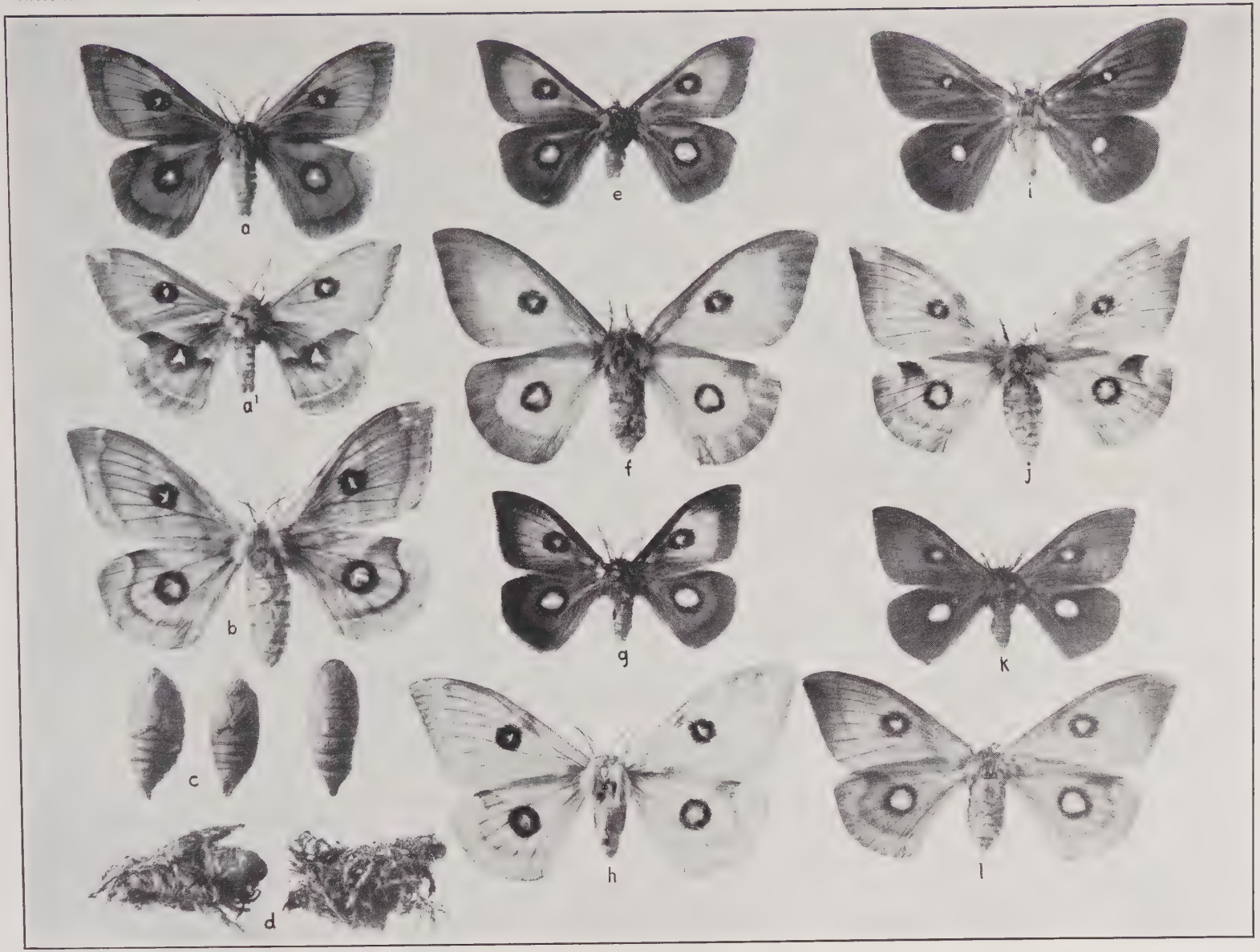
A. tau, pale female. Fig. H. Bred from eggs on hawthorn by J. H. W.

A. tau melaina Gross. Fig. i, male; j, female. Bred by H. Huemer, Lower Austria.

A. tau weismanni Standfuss, form *subcaeca.* Fig. k, male.

A. tau weismanni Standfuss. Fig. l, female. Bred by H. Huemer, Lower Austria.

All in collection of J. H. Watson.—J. H. Watson.

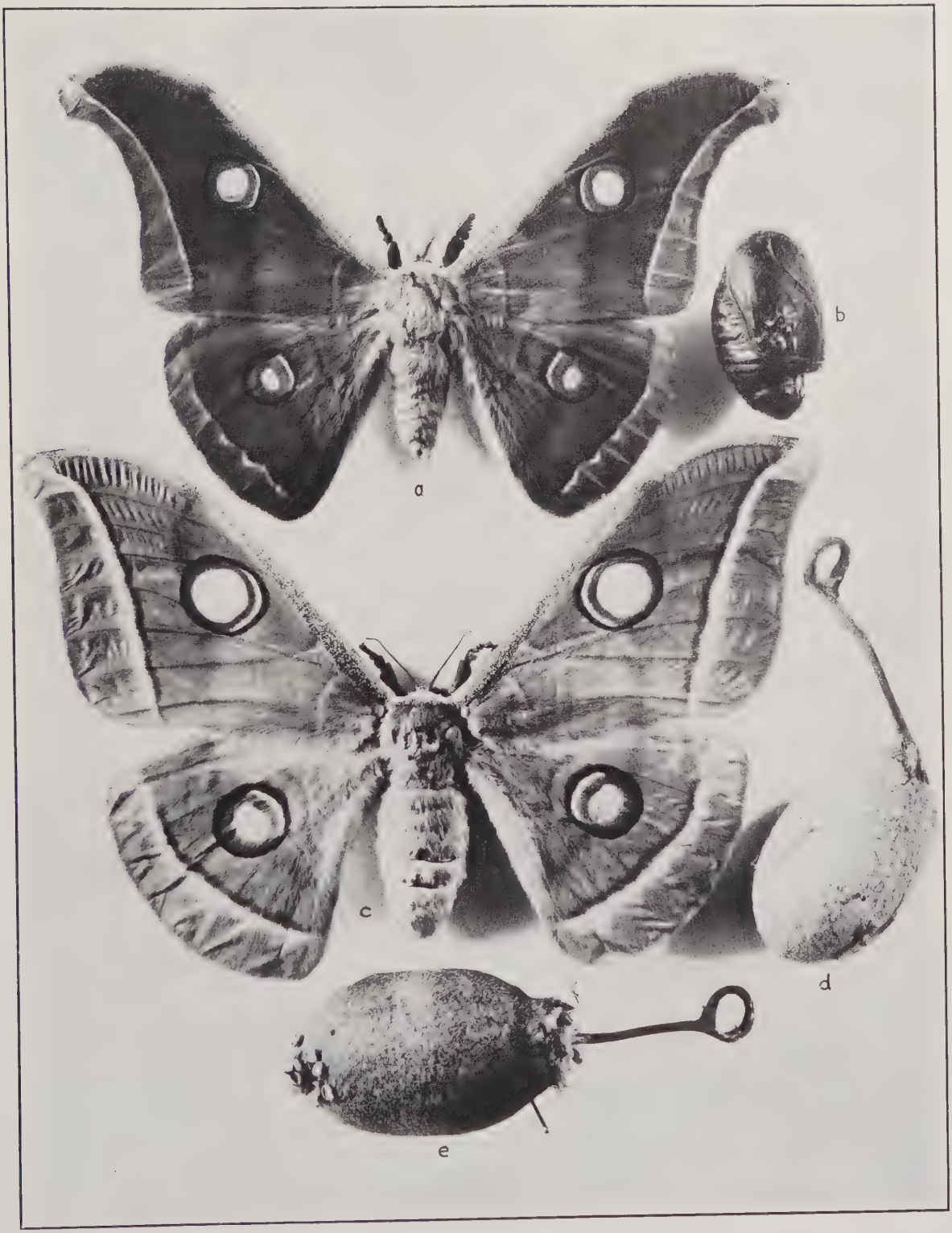


AGLIA TAU.

PLATE CIV.

Antheraea mylitta (Drury). Bred J. H. W. from cocoons gathered at Chaibassa, Bengal, India. Fig. a, male; b, pupa; c, female; d, live cocoon; e, cocoon after emergence. The male is the typical Bengal form. The female is the golden yellow form always found with the ordinary brown females in Bengal.

In collection of J. H. Watson.—J. H. Watson.



ANTHERÆA MYLITTA.

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PLATE CV.

Loepa katinka (Westwood). Fig. a, male; b, female; c, pupa; d, cocoon. Bred J. H. W. from cocoons from Silhet India.

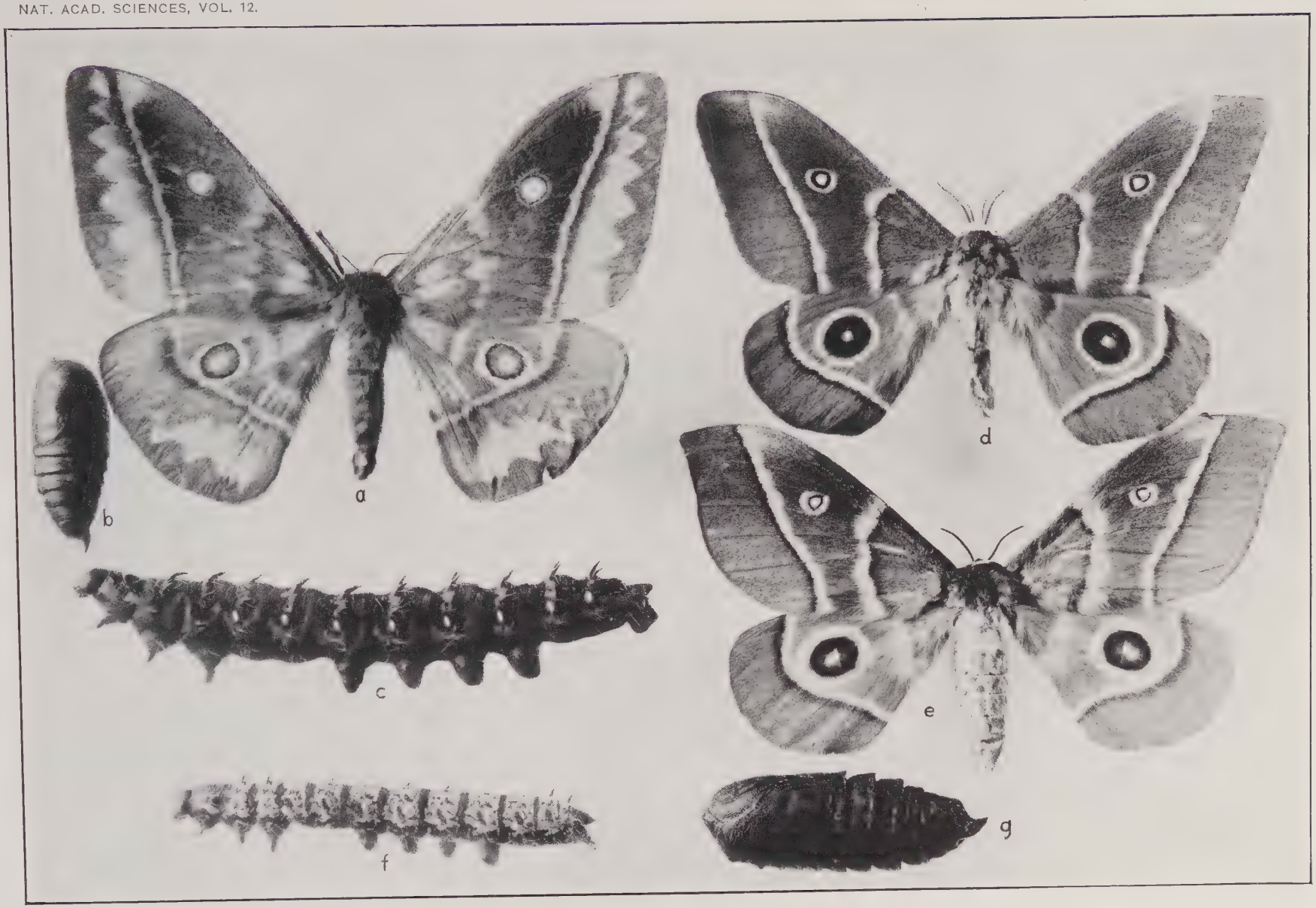
Copaxa lavendera (Westwood). Fig. e, male; f, female; g, portion of outer cocoon; h, portion of inner cocoon; i, male pupa; j, cocoon. Bred J. H. W.; from cocoons from Cuernavaca, Mexico (A. A. Chaillet).

In collection of J. H. Watson.—J. H. Watson.

LOEPA AND COPAXA.

PLATE CVI.

Nudaurelia wahlbergi (Boisduval). Fig. a, female; b, pupa; c, larva.
Gonimbrasia belina [=*Acanthocampa belina* (Westwood)]. Fig. d, male; e, female; f, larva; g, pupa.
In collection of J. H. Watson.—J. H. Watson.



NUDAURELIA AND ACANTHOCAMPA.

PLATE CVII.

Bunaea alcinoë (Stoll). Fig. a, male. Bred from larva by G. F. Leigh, Durban, South Africa.
Bunaea vinosa Riel, 1910. Fig. b. Bred from larva by Gaston Melou, Senegal, West Africa.
Melanocera menippe (Westwood). Fig. c, male; d, female, under surface; e, pupa. Bred from larva, German East Africa.

In collection of J. H. Watson.—J. H. Watson.

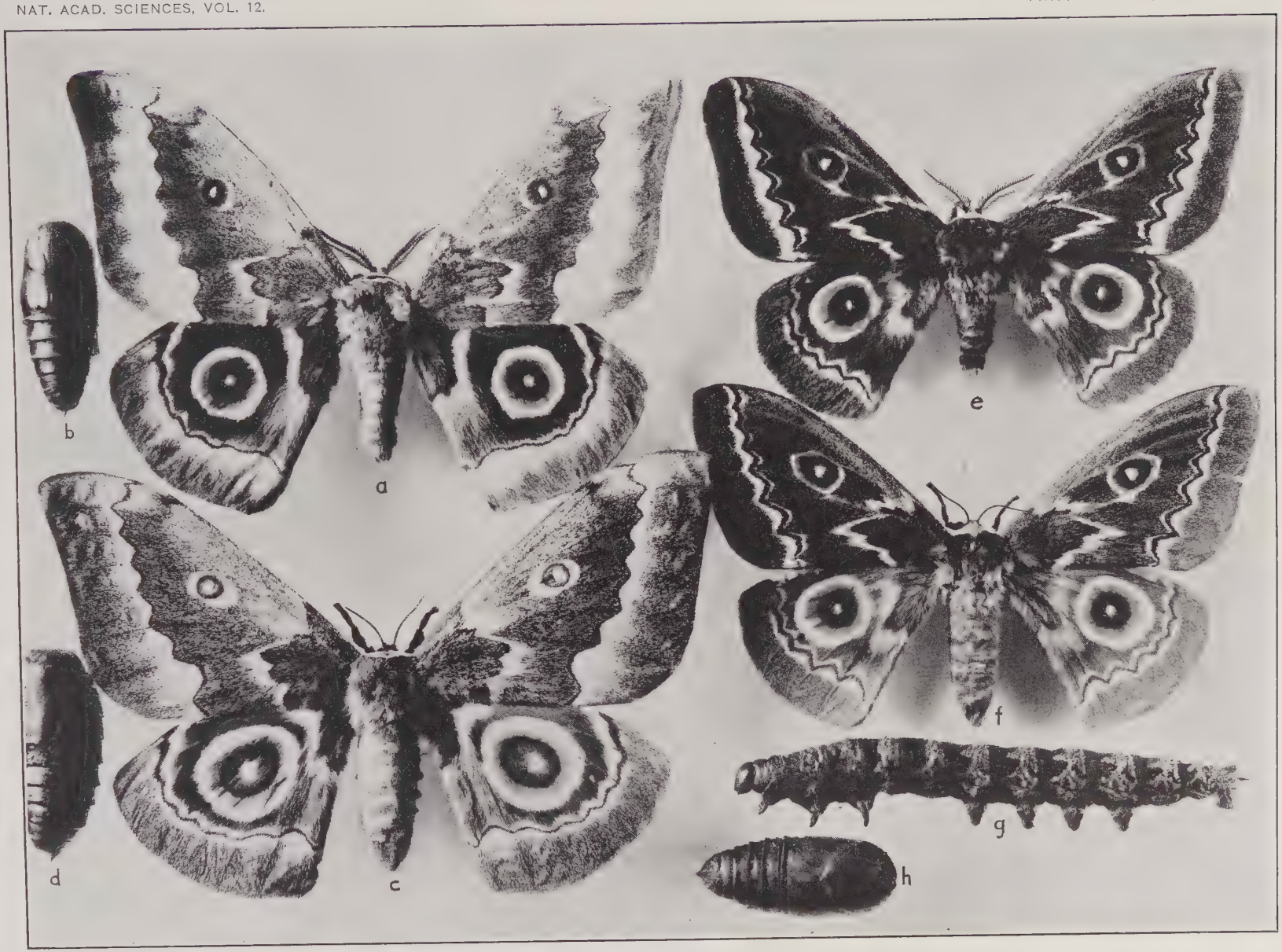
BUNÆA AND MELANOCERA.

PLATE CVIII.

Gonimbrasia zambesia (Felder) [=*Angelica zambesina* (Walker)]. Fig. a, male; b, male pupa; c, female; d, female pupa. Bred from pupa, German East Africa.

Thyella tyrrhea (Cramer). Fig. e, male; f, female; g, larva; h, male pupa. Bred from larvæ at Durban, South Africa (G. F. Leigh).

In collection of J. H. Watson.—J. H. Watson.



GONIMBRASIA AND THYELLA.

PLATE CIX.

Gynanisa isis (Westwood). Fig. a, male; b, larva; c, male pupa. Durban, South Africa. (G. F. Leigh).

Gynanisa isis westwoodi (Rothschild). Fig. d, female; Kavirondo Bay, Victoria Nyanza, East Africa. Bred from larva by Mrs. J. Ainsworth.

Imbrasia epimethea (Drury). Fig. e, male; f, female; g, pupæ. Bred of J. H. W. from pupæ from German East Africa.

In collection of J. H. Watson.—J. H. Watson.

GYNANISA AND IMBRASIA.

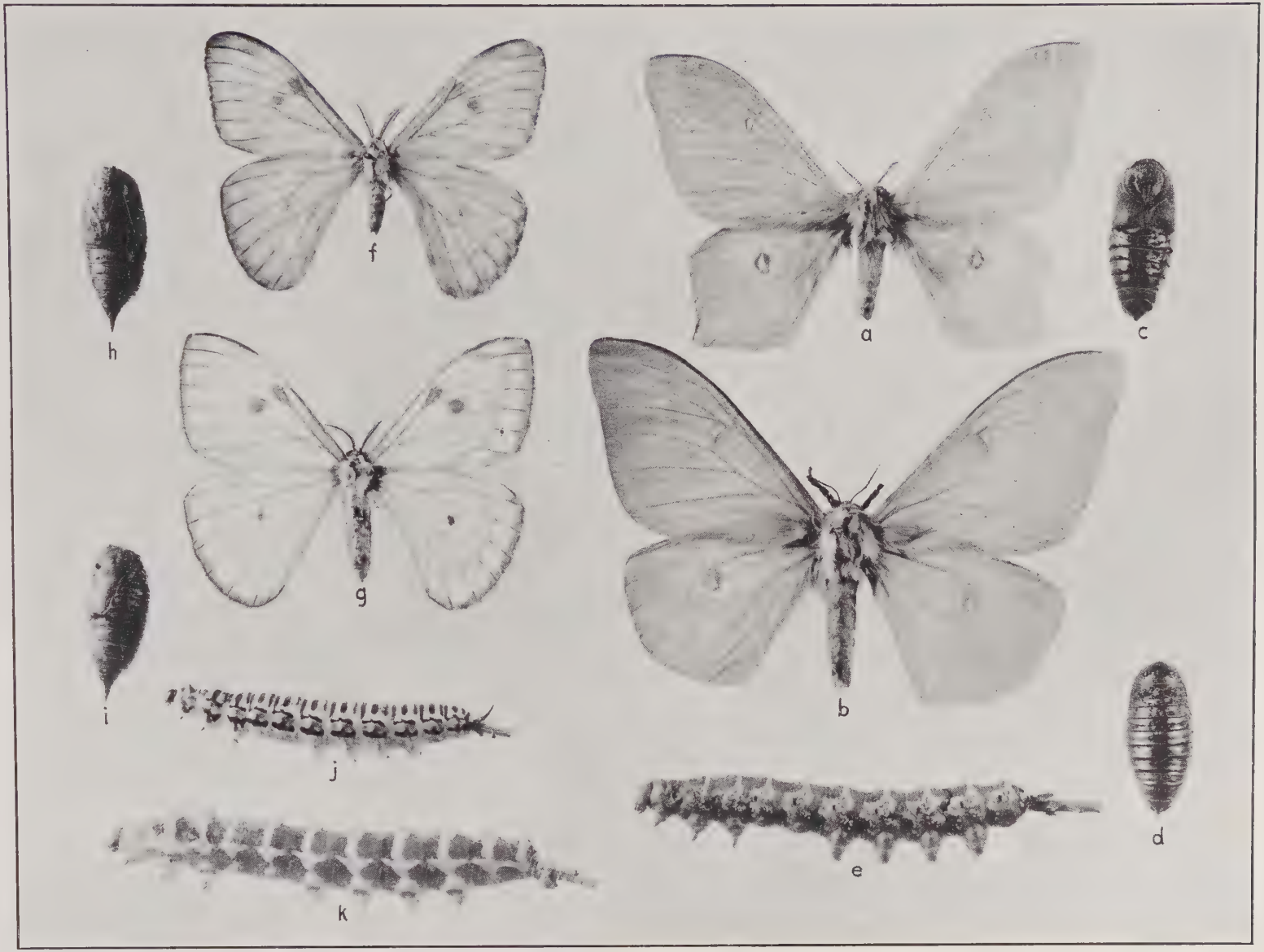
PLATE CX.

Cirina forda (Westwood). Fig. a, male; b, female; c, d, pupæ; e, larva. Bred by G. F. Leigh, Durban, South Africa.

Pseudaphelia apollinaris (Boisduval). Fig. f, male; g, female; h, i, pupæ; j, larva. Bred by G. F. Leigh, Durban, South Africa.

Urota sinope (Westwood). Fig. k, larva, Durban, South Africa (G. F. Leigh).

In collection of J. H. Watson.—J. H. Watson.



CIRINA, HENIOCHA, AND UROTA.

PLATE CXI.

Holocera smilax (Westwood). Fig. a, male; b, female. Durban, South Africa (G. F. Leigh).

Ludia delegorguei (Boisduval). Fig. c, male; female; e, pupa shell; f, larva; g, cocoon. Durban, South Africa (G. F. Leigh).

Cyrtogone [*Micragone*] *herilla* (Westwood). Fig. h, male; i, female. Sierra Leone, West Africa.

Cercophana frauenfeldi Felder.[1] Fig. j, male. Valdivia, Chili (A. v. Lossberg).

Neocercophana sp. Fig. k, male; l, female. Valdivia, Chili (A. v. Lossberg). From collection of C. Oberthür.

All in collection of J. H. Watson.—J. H. Watson.

[1] [Dr. Dyar states that this figure represents *Eudelia rufescens* Philippi. Mr. Watson submitted the figure to Dr. K. Jordan, who considers that it is correctly named *C. frauenfeldi*, as this name has priority, the two names being considered applicable to forms of a single species. The material in the U. S. National Museum labeled *Eudelia rufescens*, which I have since examined, is certainly identical with figure j. The species in that collection labeled *Cercophana frauenfeldi* (one male, without locality) is quite different; smaller, with short tails like *Neocercophana*, no white discal spot on primaries, primaries crossed near middle by two zigzag lines close together, and beyond this a series of spots.]

HOLOCERA, LUDIA, MICRAGONE, CERCOPHANA, AND NEOCERCOPHANA.

PLATE CXII.

Opodiphtera pristina (Walker). Fig. a, male; b, female. Owgarra. Upper Aroa River, British New Guinea, February, 1895 (A. S. Meek). From collection of Rothschild.

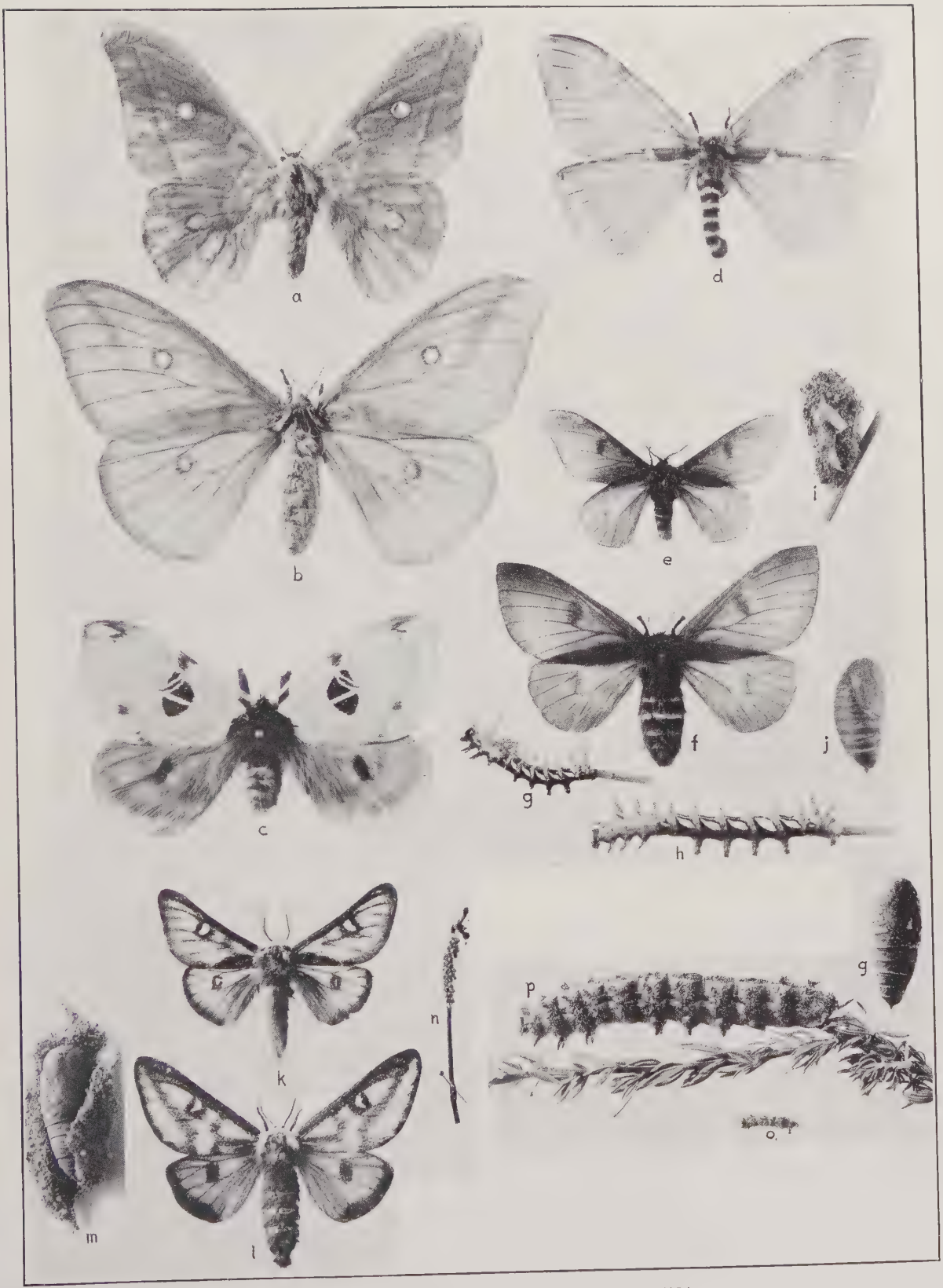
Dirphia [*Hyperdirphia*] *tarquinia* (Cramer). Fig. c, male.

Dirphia hoegei Druce. Fig. d, female. Cuernavaca, Mexico (A. A. Chaillet).

Hylesia muscula. Fig. e, male; f, female; g, larva, fourth stage; h, larva, fifth stage; i, cocoon; j, pupa. Bred J. H. W. from eggs, on *Rosa;* the original cocoons from Brazil.

Hemileuca electra Wright. Fig. k, male; l, female; m, cocoon of sand grains, held together by slight silk threads; n, eggs; q, female pupa; o, larva in third stage; p, larva in last stage; on *Eriogonum fasciculatum*. San Diego, Cal. (L. E. Ricksicker). Imagos hatched August, 1911.

All in collection of J. H. Watson.—J. H. Watson.



OPODIPHTERA, DIRPHIA, HYLESIA, AND HEMILEUCA.

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PLATE CXIII.

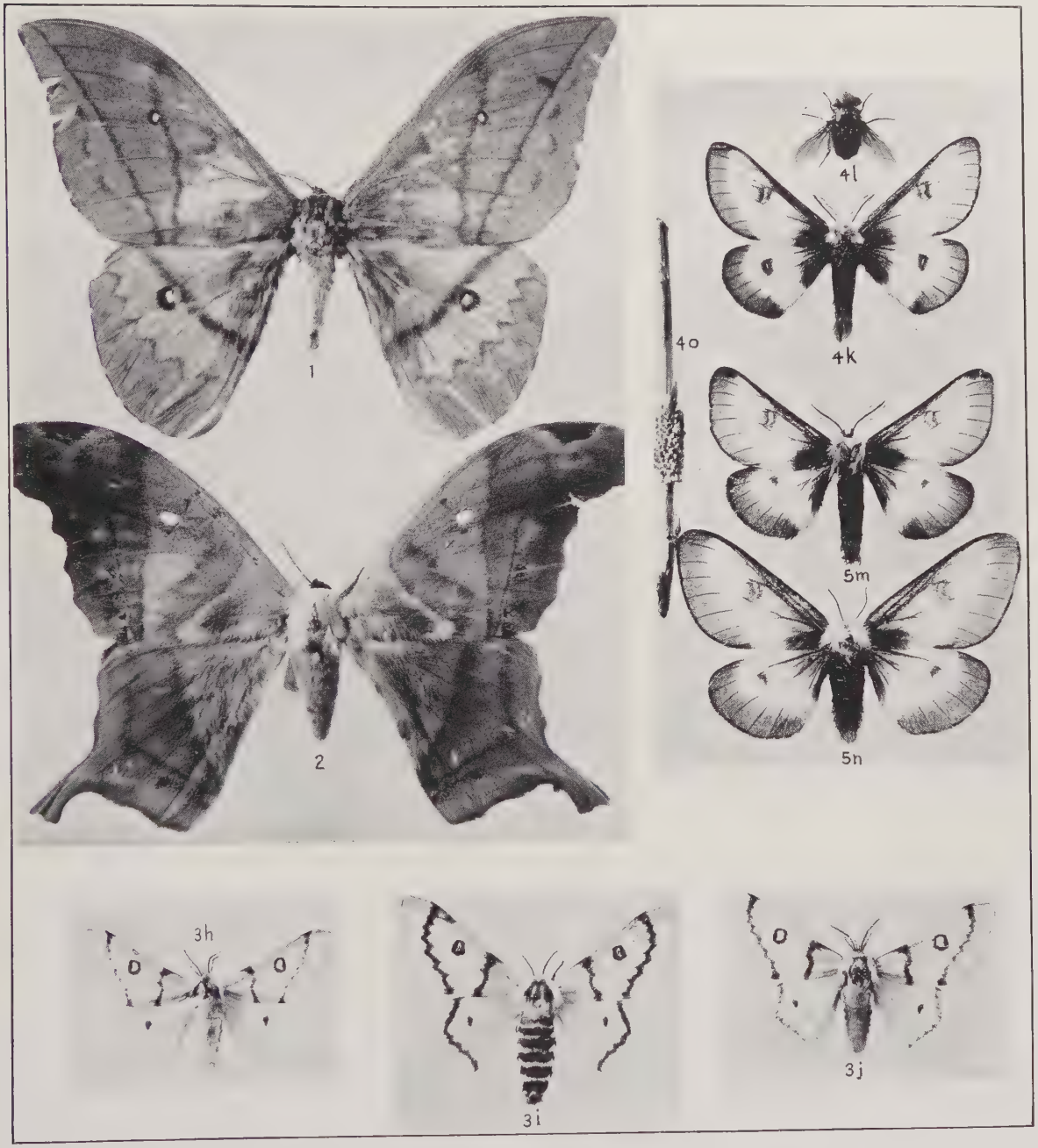
Fig. 1.—*Cremastochrysallis arenosa.* Male. Cameroon. West Africa (L. Conradt). From collection of C. Oberthür. [*C. arenosa* Maassen in litt., was published by Sonthonnax as a synonym of *C. arnobia* (Westwood). Mr. J. H. Watson considers it a distinct species.]

Fig. 2.—*Dysdaemonia tamerlan* (Maass.). Male. British Guiana. From collection of Rothschild. Watson photograph.

Fig. 3.—*Hemileuca burnsi* Watson. h, male; i, female; j, male ab. *ilmae* Watson. Bred J. H. W. from pupæ from Truckee Pass and Reno, Nev., September 4 and 5, 1911.

Fig. 4.—*Hemileuca maia nevadensis* (Stretch). k, male, Reno, Nev. (F. Burns). l, dipterous parasite [probably *Sturmia*] from two-year pupa of *H. nevadensis;* o, eggs of *H. nevadensis* on *Salix.* Watson photograph.

Fig. 5.—*Hemileuca maia californica* (Wright). m, male; n, female. San Bernardino, Cal., 1902 (W. G. Wright).



CREMASTOCHRYSALLIS, DYSDÆMONIA, AND HEMILEUCA.

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